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IN THE

Supreme Court of the United States

OCTOBER TERM, 1943

No. 392

UNIVERSAL OIL PRODUCTS COMPANY,
Petitioner,

vs.

GLOBE OIL & REFINING COMPANY,
Respondent.

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE SEVENTH CIRCUIT

BRIEF FOR PETITIONER, UNIVERSAL OIL PRODUCTS COMPANY.

WM. DWIGHT WHITNEY,
Counsel for Petitioner.

WILLIAM F. HALL,
CHARLES M. THOMAS,
FREDERICK W. P. LORENZEN,
Of Counsel.

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ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE SEVENTH CIRCUIT

BRIEF FOR PETITIONER, UNIVERSAL OIL PRODUCTS COMPANY

I

OFFICIAL REPORTS OF DECISIONS

The majority and concurring opinions of the Seventh Circuit Court of Appeals in the instant case are reported at 137 F. 2d 3, and appear in the record (VII, 3575*). The opinion of the District Court (HOLLY, *J.*) is reported at 40 F. Supp. 575 and appears in the record (VI, 3035).

The decision of the court below is in conflict with the decisions of the Delaware District Court (NIELDS, *J.*) and the Circuit Court of Appeals for the Third Circuit on the

*References to the record are by a Roman numeral to indicate the appropriate volume and an Arabic numeral to indicate the page.

same matter in *Universal Oil Products Co.* v. *Winkler-Koch Engineering Co.*, hereinafter called the "*Root* case", 6 F. Supp. 763, affirmed *sub nom. Root Refining Co.* v. *Universal Oil Products Co.*, 78 F. 2d 991, certiorari denied, 296 U. S. 626.

In addition to his opinion after final hearing, District Judge HOLLY filed three earlier opinions as follows: (a) an opinion (27 F. Supp. 161) holding that respondent was privy to the defense of the *Root* case and was bound to its outcome; (b) an opinion (31 F. Supp. 665) which, while not reversing the earlier holding that respondent was privy to the defense of the *Root* case, held that respondent was no longer bound to its outcome because Root had made a settlement with petitioner of the amount of its liability and therefore respondent would not have a further opportunity to litigate the issues in the Third Circuit on the final accounting; and (c) an opinion, (I, 460; not officially reported), denying respondent's contention that the complaint should be dismissed on the ground of unclean hands and holding that petitioner had not been guilty of unclean hands.

II

JURISDICTION

This Court has jurisdiction under Section 240(a) of the Judicial Code, as amended by the Act of February 13, 1925, 28 U. S. C. 347, and under Section 262 of the Judicial Code, Act of March 3, 1911, 28 U. S. C. 377. The case arises under the patent laws. The judgment of the court below is final in that it affirms the judgment of the District Court dismissing the complaint (VII, 3585). Certiorari was granted herein November 15, 1943.

III

SUMMARY STATEMENT OF THE CASE

This is a patent infringement suit based on Dubbs patent 1,392,629, dated October 4, 1921 (VII, 3089) and Egloff patent 1,537,593, dated May 12, 1925 (VII, 3095). Infringement was asserted of all of the claims of both patents, except the sixth claim of 1,392,629. Both patents expired during the litigation in the courts below.

The District Court held the Dubbs patent valid but not infringed (C. L.* 2, VI, 3060). It held the Egloff patent invalid and did not pass on its infringement (C. L. 12, VI, 3061). The majority opinion of the Court of Appeals (opinion by Judge EVANS, Judge MAJOR concurring) was simply that neither patent was infringed. Judge LINDLEY, specially concurring, was of the opinion that both patents were invalid but that if the Dubbs patent was valid it was infringed (137 F. 2d 8).

In the *Root* case the District Court held both patents valid and infringed, and the Court of Appeals (BUFFINGTON, DAVIS and THOMPSON, *JJ.*) unanimously affirmed.

Each of the patents in suit is for a process for producing gasoline from petroleum by "cracking". Respondent, like the defendant in the *Root* case, was charged with infringement because of its use of a so-called "Winkler Koch" cracking unit designed and installed by Winkler Koch Engineering Company of Wichita, Kansas.

The accused process in the case at bar is the same as that involved in the *Root* case (II, 695-7). Some minor differences in operating conditions appear (II, 696), but none of these has been urged by respondent in the courts

*References to "C. L." are to the Conclusions of Law of the District Court.

below to be of substance. Judge HOLLY (40 F. Supp. 584) specifically recognized a conflict between his decision and those of the courts in the *Root* case on the issue of infringement of the Dubbs patent.

History of the Litigation

The original complaint was filed July 22, 1931 (I, 15) in usual form. The original plaintiff was Universal Oil Products Company (a South Dakota corporation). An answer setting up the usual defenses of invalidity and non-infringement was filed March 2, 1932 (I, 23). On October 13, 1936 a bill in the nature of a supplemental bill was filed by petitioner, the effect of which was to substitute it (a Delaware corporation) for the original plaintiff (I, 37).

Plaintiff Held Not Guilty of Unclean Hands

Subsequently, respondent amended its answer (I, 66), and filed affidavits of respondent's counsel J. Bernhard Thiess, alleging that petitioner was barred from equitable relief on the ground of unclean hands (I, 71-7). Respondent's contention was that petitioner had attempted to impair the proof of alleged prior invention by one Otto Behimer, an employee of The Texas Company. The issue so raised was preliminarily tried in open court, resulting in findings of fact (I, 463-8), conclusions of law (I, 468) and an opinion wholly absolving petitioner of the charges made (I, 460-3).

Root Case Held Not *Res Adjudicata*

After disposition of the unclean hands defense, the District Court held a preliminary hearing on the issue of *res*

adjudicata (I, 39-57), which had been raised by an amendment to the complaint after the denial of certiorari in the *Root* case by this Court. This issue was raised upon evidence that both the Root and Globe Companies were members of the self-styled "Patent Club" of refining companies which had been organized by the Winkler-Koch interests to defend patent infringement suits, and under which each of the members (including both Root and Globe) had made contributions to a "defense fund" (I, 41-2, 44-51, 53). The District Court, on proof of these facts and on proof that the Patent Club had controlled the conduct of the defense in the *Root* case, held the decree in that case to be "conclusive against the Globe Oil and Refining Company on the issues of the validity and infringement of the Dubbs and Egloff patents" (27 F. Supp. 161, 167).

Thereafter, Root Refining Company, independently of the other members of the defense group, made a settlement with petitioner, pursuant to a right which Root had reserved when it entrusted the defense of its case to the "Patent Club" (27 F. Supp. 162-3).

In this state of facts respondent petitioned for a rehearing on the issue of *res adjudicata*. The District Court thereupon held that by the settlement respondent in the case at bar had been deprived of the opportunity to secure another review of the issues of validity and infringement after the accounting, and that consequently "the issues of the validity of the patents and their infringement by defendant herein are open for litigation in this case, and that Globe is not now bound by the decree in the Root case" (31 F. Supp. 667).

Petitioner did not urge *res adjudicata* in the Court of Appeals (VI, 3068) and does not do so here.

Trial on the Merits

Validity

The case then went to final hearing. The District Judge thereafter filed an opinion in which he dealt at length with the history of the Dubbs invention and the shortcomings of the prior art (VI, 3035-51; 40 F. Supp. 575). He agreed with and accepted the judgment of "the recognized experts in the art" who "saw the Dubbs process as new and revolutionary" (F. F.* 23, VI, 3057; VI, 3043; 40 F. Supp. 579). He rejected all defenses based on prior patents (F. F. 5-23, VI, 3052-7) and the defense of prior invention by Behimer (F. F. 24-7, VI, 3057-8) and concluded that the Dubbs patent was valid (C. L. 2, VI, 3060).

Infringement

On the issue of infringement of the Dubbs patent, Judge HOLLY held for respondent (C. L. 2, VI, 3060). He did not differentiate in any way between the accused process and that described in the Dubbs specification, but based his holding solely on the meaning which he attributed to the word "vaporization" appearing in the claims (F. F. 30-4, VI, 3059). The holding of non-infringement was a matter of construction of the patent document and did not involve any resolution of conflicting evidence as to the accused process, the facts as to its operation having been stipulated (I, 473-9).

Judge HOLLY held the Egloff patent invalid; he did not pass upon the issue of infringement.

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*References to "F. F." are to the Findings of Fact of the District Court.

Court of Appeals Decision

The Court of Appeals affirmed (137 F. 2d 3). The majority opinion accepted respondent's contention as to the meaning to be attributed to the word "vaporization" and, on this single issue (*id.* at 6) affirmed the District Court's holding that the Dubbs patent was not infringed. On the other hand, Judge LINDLEY, specially concurring, was apparently convinced that petitioner's position was the sound one on this issue for, while stating that he thought the Dubbs patent was invalid in view of prior art patents, he observed that "if the Dubbs patent is valid, it is infringed by the Globe Oil & Refining Company process" (*id.* at 8).

The majority opinion did not adopt Judge HOLLY's opinion on the Egloff patent, stating: "nor are we disapproving of it. We rather choose to place our conclusion on the ground that there was no infringement" (*id.* at 7). Judge LINDLEY was of the view that the Egloff patent was invalid (*id.* at 8).

IV

STATEMENT OF FACTS

The Art Involved Prior to Dubbs

Petroleum Oil, its Distillation and "Cracking"

Petroleum, or crude oil, is not a single chemical substance but contains a large number of different chemical substances having different physical properties, *e. g.*, different boiling points (II, 635-6). These substances are all "hydrocarbons"; that is to say, their molecules are composed of atoms of hydrogen and carbon (II, 635; F. F. 3, VI 3052). The substances differ from one another because their molecules contain differing numbers of carbon and

hydrogen atoms or because the atoms are differently arranged within the molecule (II, 635-8; F. F. 3, VI, 3052).

The problem of the oil refiner is to extract from the crude oil the oils of commerce, such as gasoline, naphtha, kerosene, fuel oil, etc. (II, 639-40). In ordinary distillation there will be produced after kerosene and before fuel oil what is known as gas oil.

Taking a typical Mid-Continent crude as an example, approximately 25% of the crude may be recovered as gasoline by simple distillation, 5% to 7% as kerosene, 30% as gas oil, and the balance, 38% to 40%, as fuel oil. The separation may be stopped after the removal of the gasoline or of the kerosene, the balance being then known as topped crude, which thus represents about 70% of the total crude (II, 642).

Fuel oil and topped crude are heavier and of lower market value than gas oil, and upon cracking form a greater quantity of carbon or coke (I, 536-7). They also of course represent a larger proportion of the crude than does gas oil.

The process of cracking involves the breaking up of hydrocarbon molecules so that they re-arrange themselves into lighter molecules with an accompanying formation of other molecules heavier than those in the original oil (II, 648-9; F. F. 4, VI, 3052). The result is that cracked oil contains more light molecules, *e.g.*, those coming within the gasoline range, and molecules heavier than those present in the original crude oil. Accordingly, cracking produces a large yield of gasoline, but, concomitantly, the process produces heavy liquid fractions such as fuel oils, tars and asphalts and even solid residues generally designated in the parlance of the industry by the words "carbon" or "coke".

The Problem in the Art Prior to Dubbs

The history of cracking prior to the Dubbs invention is set out in the District Court's findings (VI, 3052-8) in much the same manner as stated by Mr. Justice Brandeis, delivering the opinion of this Court in *Standard Oil Co. v. United States*, 283 U. S. 163, 167:

> "* * * For about half a century before 1910, gasoline had been manufactured from crude oil exclusively by distillation and condensation at atmospheric pressure. When the demand for gasoline grew rapidly with the widespread use of the automobile, methods for increasing the yield of gasoline from the available crude oil were sought. It had long been known that, from a given quantity of crude, additional oils of high volatility could be produced by 'cracking'; that is, by applying heat and pressure to the residuum after ordinary distillation. But a commercially profitable cracking method and apparatus for manufacturing additional gasoline had not yet been developed. The first such process was perfected by the Indiana Company in 1913; and for more than seven years this was the only one practiced in America."

The Burton and Burton-Clark Processes

The processes which the Indiana Company perfected were known as the Burton and Burton-Clark processes. The District Court found that these "constituted the state of the art as practiced commercially when Dubbs appeared on the scene" (F. F. 9, VI, 3054).

The *Burton* process was a *batch** process and was carried out in apparatus illustrated in Plate I of the Supple-

*A batch cracking process is one in which a given quantity of oil (a batch) is subjected to cracking conditions of temperature and pressure and in which no unvaporized oil or residue is withdrawn during the operation.

ment*. The apparatus included a large steel vessel or "shell still" (indicated at 1 in the drawing) mounted in a furnace setting (2). The charge, consisting of a "batch" of about 8,250 gallons of a light "gas oil" produced from crude petroleum by distillation, was placed in this vessel and heated to a temperature of 700-750° F. (I, 487-8). The heat caused the oil to crack (F. F. 5, VI, 3052).

Vapors were generated and liberation of vapors from the liquid body took place in the shell still. The vapors passed off through an inclined vapor line (4) to an aerial or partial condenser (5). In the condenser (5), the heavier part of the vapors coming from the line (4) were condensed and part remained uncondensed. The uncondensed part passed from the top of the condenser (5) into a final condenser (6) where such of them as were condensible were liquefied.** The liquefied final condensate was collected in a vessel (7). This product, known as "pressure distillate", became gasoline after further refining operations not important here. Those portions of the vapors which were liquefied or condensed in the initial condenser (5) were known as "reflux condensate" and flowed back in copious amount to the still by gravity to be again heated and converted to vapor (I, 486-7; II, 646-7). The residue remained in the heating and cracking shell still during the run.

It required about 12 hours after the fires were lighted to bring the contents of the still up to the proper temperature and pressure, that is to say, to bring the unit

*References to the "Supplement" are to the Supplement to this Brief.

**Some of the vapors formed were uncondensible and existed as fixed gases. These were drawn off from vessel (7) through lines (9).

"on-stream"* (I, 486-7; F. F. 5, VI, 3053). The unit remained on-stream for a maximum of 24 hours (I, 488; F. F. 5, VI, 3053). It then became necessary to quench the fires, withdraw the oil remaining in the still and remove the carbon or coke which had been formed during the operation and had adhered to the inner wall (*ibid.*). This cleaning period required another 12 hours (*ibid.*).

The *Burton-Clark* process, another "batch" type process, came into use about 1915 and was an improvement of the Burton process (I, 489; F. F. 7, VI, 3053). It was carried out in apparatus shown in Plate II of the Supplement. This apparatus differed from Burton in that, instead of the fire being directly applied to the shell (1), it was applied to a series of tubes (3) placed within the furnace setting and connected at their ends to the vessel by hollow legs (3a and 3b), the oil circulating through this system by convection (*ibid.*). The oil charged remained a light gas oil. As in the Burton process, no residue was withdrawn during the run; all the liquid oil was cycled round and round through the heating tubes (3) and the shell (1) continuously during the run (I, 489; F. F. 7, VI, 3053).

The cycle of operation was 72 hours, which included 15 hours to bring the still up to pressure, 36 hours on-stream and the remainder for shutting down, cleaning and getting the still ready for the next cycle (I, 490; F. F. 8, VI, 3053-4).

The Burton and Burton-Clark processes, while the first successful cracking processes in the art, had serious disadvantages, in addition to the shortness of their on-stream periods. They were workable only with a distillate charging

*"On-stream" is the period of time when the still is producing gasoline (II, 614).

stock such as light gas oil (I, 488-9; F. F. 10, VI, 3054). Even then, the gasoline yields were only about 25% to 28% of the oil charged in the Burton process (I, 488; F. F. 6, VI, 3053) and about 30% to 32% in the Burton-Clark process (I, 490).

The limitations of yield, charging stock and length of run were imposed on these processes by the accumulation of carbonaceous material in the heating elements of the stills. This not only required frequent shut-downs for cleaning, but presented a serious hazard to life and property (F. F. 6-8, VI, 3053-4). These carbon deposits were a potential cause of explosion, for they caused overheating and weakening of the walls of the heated shell or tubes (F. F. 6, 8, IV, 3053-4). Several such explosions had occurred (I, 488). Indeed as Daniel Pyzel, who was in charge of refinery operations for the Shell group in the United States, testified (I, 520-1):

> "At that time people were still afraid and I would say very much afraid of a cracking plant."

These processes not only were themselves expensive to operate, but, during the shut-down periods, the equipment was idle, and the large investment which it represented was non-productive.

The Vapor Phase Processes

Contemporaneously with the use of the Burton and Burton-Clark processes, and prior to the filing date of the application for the Dubbs patent in suit (1916-1918), workers in the cracking art were endeavoring to develop an essentially different type of process called the "Vapor Phase" process. It derived its name from the fact that in such a process the purpose was first to convert the oil into vapor and then to subject the vapor, separated from or free of liquid oil, to cracking.

The vapor phase process was exemplified by the Hall patent (VII, 3200), the Alexander patent (VII, 3372), the Greenstreet patent (VII, 3476), the Ellis patent (VII, 3352), and the Biddison and Boyd patent (VII, 3336).

The processes of the Hall and Alexander patents were given a fair trial under the aegis of the patentees themselves in the refineries of The Texas Company (II, 846-7, 866-8) and the Gulf Refining Company (III, 1347-8), respectively. The Texas Company spent $100,000 in constructing a Hall experimental plant (II, 866). The Gulf Refining Company spent $1,500,000 in the installation of a plant embodying the teachings of the Alexander patent (III, 1348).

The cost of production of gasoline by the Hall process was 68 cents per gallon (II, 976, 981). The gasoline yield based on the charge in the Alexander process was but 6 or 7% (III, 1351).

After extended tests, these processes were abandoned (II, 975-6; III, 1548; F. F. 15, VI, 3055; F. F. 17, VI, 3057).

They failed because, when treating charging stocks other than very light and expensive materials such as kerosene and light gas oils, and when attempting to produce substantial yields of gasoline, coke or carbon deposited in the heated tubes of the units, forcing their shut-down (II, 852, 867-8; DX* 628, p. 12, V, 2427; III, 1350-1, 1355).

This deposit of coke or carbon was the result of the fact that in these operations separation of the vapors from the liquid oil occurred in the heated tubes (III, 1350, 1364-5, 1407-8).

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*References to "DX" are to Defendant's Exhibits.

The Trumble and Similar Processes

The Trumble process was the cracking process on which the Royal Dutch-Shell group was working at the time of Dubbs' advent. It was typical of the processes which the industry, seeking to improve upon the Burton-Clark process, was then endeavoring to develop, such as the Hanna and Richmond stills of the Standard Oil of California.

In the Trumble process (Patent 1,281,884, VII, 3295; Plate VIII, Supplement), the fresh oil is fed from pipe (43) and passed by means of pump (8) at a high velocity (VII, 3295, l.* 80 to 3296, l. 5) through the cracking coil (1) where high efficiency of heat transference is obtained (VII, 3295, ll.* 90-4). From coil (1) the oil, in the form of an intimate and foamy mixture of vapor and liquid (VII, 3295, ll. 80-5, 95-99), discharges into the top of a vapor releaser (2). There the vapors separate from the unvaporized oil. The vapors pass through pipes (45) to partial condensers, called "dephlegmators", (4) where partial condensation forms reflux condensate. The latter passes through pipes (66), (67) and (68) to the chamber (3). The residue from the vapor releaser (2) also passes to the chamber (3). A large part of the mixture of reflux condensate and residue is returned to coil (1) from chamber (3) through pipes (40) and (41), joining with the fresh feed at the pump (8), and is thereby cycled through the system.

Thus in the Trumble process a large part of the residue from the vapor separating step—the patent suggests as much as 95%—is cycled through the heating coil. The balance, a small amount of heavy oil and included solids (VII, 3296, ll. 33-51), is bled from the system through pipe (44).

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*References to l. and ll. are to the numbered lines of the respective patents.

The Trumble patent repeatedly emphasizes that the stream of oil undergoing treatment, including residue, is circulated around and around, or cycled, in a closed ring.

After 1924, the Trumble process was commercially embodied in the so-called "Jenkins" process. *Cf. Skelly Oil Co. v. Universal Oil Products Co.*, 3 Cir., 31 F. 2d 427. While the length of run of these modern Jenkins stills extended materially beyond the length of the Burton-Clark run, the charging stock and the yields were as limited as in the latter.

The difficulty with Trumble and other similar processes, such as the Hanna and Richmond stills of the Standard Oil of California or the processes of the Smith patent 1,239,423 (VII, 3224) and Edwards patent 1,170,884 (VII, 3182), was that, as the lighter vapors were drawn off, the oil which was used in the cycling inevitably became heavier and heavier so that, despite the introduction of fresh feed, there was inevitably coking in the tubes of the heating zone when increased yields of gasoline were sought. The prior art had not realized that the liquid unvaporized oil so cycled would, upon further heating, form heavy "polymers" which would rapidly go to coke. This was the problem with which all were grappling (F. F. 9, VI, 3054).

The Carbon Problem

"Carbon was the bane of the cracking industry", as petitioner's witness Brown stated (II, 649). And respondent's witness Behimer agreed that there was "only one trouble in the cracking industry and that was carbon" (II, 909). Indeed, the seriousness of the problem is apparent from the facts above stated as to Burton and Burton-Clark. The District Court specifically found that (F. F. 9, VI, 3054):

"The Burton and Burton-Clark processes constituted the state of the art as practiced commercially when Dubbs appeared on the scene. The problem to be solved was to crack the heavier hydrocarbons to produce gasoline without coking up the vessel in which the cracking occurred. Dubbs solved the problem."

The Dubbs Process

The District Court found that (F. F. 12, VI, 3055):

"The Dubbs process was recognized immediately by the larger oil companies as a great improvement in the art, and the older processes of producing gasoline were practically abandoned."

Similar recognition was found in the *Root* case (6 F. Supp. 764-5).

Performance

That Dubbs solved the carbon problem is demonstrated by the results of the operation of the Dubbs standard units developed to carry out the "clean circulation" principle of the Dubbs patent. In the operation of the standard 500 bbls. Dubbs units (Plate VII, Supplement), the approximate duration of the runs made on gas oil was between 10 and 20 days, sometimes longer, with a yield of gasoline based on the charge of 40-50% and in many cases the yield exceeded 50 per cent (II, 612). Two examples appear in the record as of March 1925, using gas-oil as charging stock (II, 615):

(a) in the units licensed to the Waite Phillips (later Barnsdall) Company, the on-stream period extended to 22½ days, with a gasoline yield of 40.57% of the charge, also yielding a saleable residue as a by-product;

(b) the units licensed to the Arkansas City Refining Company made runs which remained on-stream 28½

days, producing yields of gasoline of 48.36% of the charge, and making a commercial fuel oil as a by-product.

Moreover, the Dubbs process was not confined to the selected gas-oil charging stock which was all that could be cracked by the Burton and the Burton-Clark processes. Dubbs could crack the more abundant and cheaper fuel oil or topped crude (I, 536).

On fuel oil, the runs of the 500 bbls. Dubbs units usually lasted from 4 to 10 days, with a yield of gasoline based on the charge of 30 to 45 percent (II, 612).

Indeed, the yields stated above can be materially increased. Huff testified that there is "no limit to the yield of gasoline that could be obtained from a charging stock *with the Dubbs process.** The higher the yield you obtained the more you would depreciate the residue. It all depended upon how far the refinery wanted to go in obtaining a high yield as to what he should do with his residue" (II, 624).

Thus the Dubbs process increased the yields substantially over those that could be obtained with the Burton-Clark process and permitted the use of a larger, heavier and less costly portion of the crude oil as cracking charge.

Burton-Clark, which could only treat gas oil, representing 30% of a typical Mid-Continent crude, thus obtained a yield of gasoline by cracking of about 10% of the crude. Dubbs could treat the entire topped crude, constituting 70% of a typical Mid-Continent crude, and thus could and did obtain a yield of gasoline by cracking of about 28% of the crude.

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*Italics ours throughout this brief, unless otherwise indicated.

Thereby, Dubbs contributed materially to the conservation of the petroleum resources of this country.

Dubbs also eliminated the hazard to life and property presented by the prior processes, and removed the refiner's fear of a cracking plant.

Apparatus and Operation

The apparatus of the Dubbs patent is illustrated in Plate III of the Supplement. Referring to that drawing, the process may be briefly described as follows: The oil to be cracked, called the "fresh feed", is supplied through a pump J to "cracking tubes" marked B in the patent and colored red in Plate III of the Supplement. Heat is applied to the outside of the "cracking tubes B", thereby raising the oil as it passes through the tubes B to the required cracking temperature (F. F. 10, VI; 3054). From the B tubes the stream discharges into enlarged "vaporizing tubes C."

All of the heat for cracking is imparted to the oil in the cracking tubes B. No heat is added to the oil in the vaporizing tubes C, although insulation or, alternatively a light fire, may be applied to these tubes, solely to compensate for the loss of heat by *radiation* (II, 654).

In the cracking tubes B, there necessarily results, under the conditions stated in the patent, a *generation* of vapors from the oil (II, 656, 726). Dubbs does not permit these generated vapors to *separate* from the liquid oil, but carries them forward in the oil as a froth or foam which fills the B tubes completely (II, 656-7). It is important to the process that stratification of liquid oil and vapor, *i.e.*, vapor separation, in the highly heated cracking tubes B shall be avoided. If such a tube condition is not avoided, coking of the tubes, with its attendant evils and risks, occurs.

As described in the patent, the cracking tubes B are four inches in diameter and so restricted in cross-section that they enable the condition of froth or foam to prevail. This contrasts with the enlarged diameter of the vaporizing tubes C (ten inches, giving a cross-sectional area over six times that of the B tubes), into which the foam is discharged from the cracking tubes. The oil only partially fills these large vaporizing tubes C wherein *liberation*, or separation, of generated vapors from the still liquid portion of the oil occurs (II, 660). The separated vapors pass upwardly through tubes D thence through vapor tubes E, a manifold G and aerial condenser G^1, wherein they are in part condensed (II, 653). The condensed oil, or "reflux condensate", returning under the force of gravity from the elevated condenser G^1 through a pipe F^1, joins with the incoming fresh oil, and is again circulated or cycled through the system (II, 654) in admixture with the fresh oil.

That portion of the vapors which is not condensed in the aerial condenser G^1 passes through a pipe G^2 into a final condenser G^3, and constitutes the end product of the cracking process (II, 654, 651). After some refining or finishing operations, it is the gasoline of commerce.

The Vitalizing Feature

It is vital to the Dubbs process that *none* of the liquid carbon-containing non-volatilized oil, or residue, remaining after the removal of vapors from the vaporizing tubes C, is cycled through the heating and cracking tubes B, and that the reflux condensate, which is cycled through the tubes B, is uncontaminated by said non-volatilized oil or residue (II, 663; F. F. 10-11, VI, 3054-5). The patent

describes that the residue is entirely withdrawn from the system by means of line K (VII, 3089, ll. 93-5; 3090, ll. 43-5).

Thus the cracking tubes B are kept carbon free. The non-cycling of any of the heavy liquid hydrocarbons, which are inevitably formed by cracking, avoids coke formation in the heating and cracking tubes B (II, 656-8). Dubbs realized that it was not sufficient to remove from the system only the *heavier* carbon containing residue, while recycling the balance of the non-volatilized oil,* for the latter upon further heating will polymerize and form coke.

Dubbs went deeper into the cracking problem as a whole than any of his predecessors. To understand this, a distinction must be drawn between two types of hydrocarbon molecules.

Some of the hydrocarbon molecules are "saturated" such as the paraffin series, in which the compound is saturated with hydrogen: it couldn't hold any more hydrogen because the carbon atoms are linked with the maximum number of hydrogen atoms (II, 636-7).

Other hydrocarbon molecules are "unsaturated", such as the olefins; these molecules do not hold their full quota of hydrogen, and compounds of this kind are much more active than the saturated compounds, for the reason that there are links between the carbon atoms which are available for uniting with other atoms or molecules (II, 638-9).

The heavy liquid products of cracking are highly unsaturated and very active at the cracking temperature. These compounds unite together and form still heavier material of still more unsaturated character. The resulting

*As for instance, in the Trumble and like processes (p. 14, *supra*).

materials can be called "polymers", meaning that they are formed by the association or coming together or "polymerization" of many other compounds (II, 647, 649).

These unsaturated heavy polymers are powerful carbon forming materials and, if they are subjected to cracking temperatures, they rapidly go to coke (II, 658).

Dubbs realized that the carbon trouble would not be cured short of preventing the return to the heating zone of *any unvaporized oil.* This was a novel and inventive concept. It solved the carbon problem which had plagued the cracking art (F. F. 9, VI, 3054). It is generally called the "clean circulation" process (F. F. 13, VI, 3055).

This solution had theretofore eluded the art. The industry was working along the lines of drawing off only a *part* of the non-volatilized oil; and, of course, making such mechanical improvements all through the system as skill or ingenuity could devise. To draw off all of the residue—all of the non-volatilized oil,—and run it all off to storage, might be described as an idea so shockingly wasteful that no great company was willing to entertain it. The description would be inadequate. The truth was that, other than Dubbs, the employee of only one great company even thought of it. The one who thought of it was Behimer of The Texas Company; but neither he nor all the talent at the command of The Texas Company knew how to make the idea work (F. F. 24, VI, 3057), and indeed The Texas Company abandoned it in favor of one more process of the old type (I, 327; II, 880-1, 937-8, 946-7, 978).*

*The Texas people used the word "backtrap" for "reflux condensate". They mixed it with the residual oil, as in Burton and Burton-Clark; they had no means for returning it to the heating coil (II, 978).

The Dubbs invention resides in the combination covered by the claims of the patent. Should any of the steps there recited, be it that expressed as "vaporization [vapor liberation] prevented" or that consisting in the non-cycling of the residue, be omitted, the operation would fail to realize the benefits of Dubbs' discovery and would again incorporate the defects and dangers of the abandoned vapor phase processes, of the Burton-Clark process, or of the Trumble and like processes. But among the steps the vitalizing one was the *total* withdrawal of residue and consequent clean circulation of uncontaminated reflux.

It was the startling simplicity, yet successful operability, of the Dubbs discovery that enlisted the remarkable recognition by small and great companies alike which is recited *infra* beginning at page 28, and on which the District Court made the following finding (F. F. 20, VI, 3056):

> "That the prior art did not teach clean circulation is shown by the fact that the great oil companies such as Texas, Gulf, Shell, and the Standard Oil Company of California, with their staffs of highly trained technical experts, never discovered this principle in the prior art."

The Dubbs Patent Claims

At the trial, claim 7 was taken as typical of the claims in suit (VII, 3091):

> "7. A process of cracking oil consisting in continuously passing a stream of oil through a series of tubes seated in a cracking zone where the oil is heated to the cracking temperature but substantial vaporization prevented, and thence to an enlarged vapor chamber where vaporization takes place, removing the vapors from said chamber, subjecting

them to an initial condenser where a portion of the vapors are condensed, subjecting the uncondensed portion of the vapors to a final condensation, returning the condensate from said initial condensation to the inlet side of the cracking tubes and continuously drawing off the residue from the vapor chamber and preventing it from returning to the cracking zone and maintaining a pressure on the oil during treatment."

History of the Dubbs Application

The application which eventuated in the Dubbs patent in suit was filed March 14, 1919. The original specification (IV, 1511), save for minor differences not important here, was the same as the specification of the patent as issued, except that the original specification did not contain the description of the "illustrative run" appearing in the issued patent at page 2, lines 32-65 (IV, 1511-5; VII, 3090, ll. 32-65). The illustrative run was added, at the request of the Patent Office (IV, 1519), by an amendment filed September 16, 1919 (IV, 1520), about six months after the filing of the original application and a decade prior to the advent of the accused process. It is nowhere suggested that any intervening use occurred between the filing of the original application and the amendment required by the Patent Office.

The claims originally filed and the illustrative run are important here because the decisions of both courts went upon the ground that respondent's process successfully evaded the patent by generating vapors in its cracking coil (the Dubbs B tubes). The evasion is sought to be supported by the phrase in the Dubbs claims stating that the operation of that part of the process which takes place in

the B tubes shall be "without substantial vaporization" (claims 1, 9, VII, 3090-1), or is to be carried on so that "substantial vaporization [is] prevented" (claims 2, 3, 4, 7, 8, VII, 3090-1), or "while preventing substantial vaporization" (claims 5, VII, 3090-1).

But the Dubbs patent, its file wrapper history, the circumstances surrounding the patent application, as well as the uniform practice under the patent, all establish that the quoted words prohibit vapor *separation* or *liberation* only; *generation* of vapors in the cracking tubes B necessarily occurs under the Dubbs teachings.

Original claims 1 and 2 called for "passing the oil through a heating coil in a cracking zone, passing the oil and *generated* vapors into a vapor chamber, taking off the vapors from said vapor chamber," etc. (IV, 1515-6; F. F. 35, VI, 3059). Thus it plainly appears that the Dubbs process, as originally described, was known by Dubbs, and *claimed* by him, to be one in which vapors were *generated* in the cracking tubes B and in which the vapors were *separated* in the vaporizing tubes C. These original claims remained in the case until the specification was amended by the addition of the illustrative run* (VI, 1520-1; VII, 3090, ll. 32-65).

The illustrative run, to those skilled in oil cracking, describes exactly what was defined by the original claims, *i.e.*, a process wherein vapors are inevitably generated as the oil passes through the cracking tubes (II, 656, 726; III, 1148-51, 1153-4). These vapors are separated in the vaporizing tubes C. The same phenomena occurred in all the Dubbs demonstration runs and in all licensed operations.

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*The illustrative run gives specific operating conditions for the process.

The words "without substantial vaporization" or their counterpart were never relied upon by Dubbs as differentiating his claims from the prior art upon which the claims stood rejected; nor were they required by the Patent Office. They were inserted so that the claims would cover only a process wherein the B tube condition—no vapor separation—was present; and would exclude the condition which had caused the failure of the vapor phase processes (II, 656-7). While the condition characterized by this phrase played an important part in the operation of the process, it was not Dubbs' contribution to the art. His contribution, constituting the clean circulation principle, was the non-cycling of the non-volatilized oil and the cycling of the uncontaminated reflux condensate.

Through all of the claims, in varying expression, there persisted the thought (*e.g.* IV, 1524) of passing the oil through "a cracking zone and a vaporizing chamber, withdrawing from said chamber the vapors arising from the oil passing therethrough", etc. Throughout the prosecution, emphasis was consistently placed by the applicant upon the cycling of the reflux condensate free from carbon containing residue and the non-cycling of such residue: that was claimed to be his contribution to the art. And he advised the patent office that "An apparatus constructed just as the apparatus shown in the present application is commercially operated and by means of this invention applicant is able to avoid these carbon troubles and is able to carry out his process continuously and uninterruptedly over a very extended period of time" (IV, 1533).

Ultimately the claims were put in proper form to express the clean circulation principle for which the patent stood. The substance of this principle was summarized

for example in typical Claim 7 as follows (VII, 3091, page 3 of patent, lines 56-64):

> "* * * returning the condensate from said initial condensation to the inlet side of the cracking tubes and continuously drawing off the residue from the vapor chamber and preventing it from returning to the cracking zone * * *."

Demonstrations of Operability of Dubbs Invention

Dubbs' representation to the Patent Office that his invention was in actual use and avoided the carbon troubles which had plagued the art (IV, 1533), was, in fact, a modest statement of his accomplishment. Prior to the filing of his patent application in March 1919, he had constructed the apparatus shown in the patent and successfully demonstrated the "clean circulation" process, for which the application stood, in a plant at Independence, Kansas (I, 376; F. F. 11, VI, 3055).

Late in 1918 or early in 1919 the process was there exhibited to Daniel Pyzel, a world-renowned chemical engineer in charge of the refinery operations of the international group of Shell companies (I, 506-8). Pyzel (I, 506-8, 517, 519-21) described the construction and operation of this unit, which followed closely the disclosure of the patent. The same unit was again demonstrated in the summer of 1919 to a number of representatives of the National Petroleum Association and the Western Refiners Association at their request (I, 377). A flow sheet of this unit appears in PX* 519 (IV, 1727) reproduced at plate VI of the Supplement. There were ten 4-inch cracking tubes (tubes B) and an enlarged 10-inch vaporizing chamber (chamber C), whence the vapors passed to an aerial

*References to "PX" are to Plaintiff's Exhibits.

condenser elevated about 20 feet, and the reflux condensate was returned from this aerial condenser by gravity for repassage with the fresh feed (a gas oil stock) through the cracking coil. A pressure of about 130 pounds was maintained in the system, and for most of the operation an active cracking temperature of 850° F. and above was maintained (PX 597, IV, 1823-61). The residuum from the vapor separation step occurring in the enlarged chamber was discharged from the system, and no part of it was returned or cycled to the heating coil.

During the summer demonstration, the refiners were asked to specify how long they desired the plant to remain on-stream, and they suggested 12 days. The demonstration run, as the contemporaneous records thereof show, continued uninterruptedly for 9 days and was then shut down, not because of any undue accumulation of carbon or because the process could not go further, but solely because the refinery representatives expressed themselves as fully satisfied (F. F. 11, VI, 3055; PX 597, IV, 1823-61). The results were published in the National Petroleum News, the Oil & Gas Journal and other publications (I, 394). No other cracking process had ever before made a comparable run (I, 377).

It is undisputed that in the original demonstration runs, cracking, with its inevitable vapor *generation*, occurred in the cracking tubes B, but vapor *liberation* did *not* occur therein (II, 687-8), the oil in these tubes being in the form of a foamy mass of liquid oil containing bubbles of generated vapors (II, 687-8). The *liberation* of the vapors from the liquid oil occurred only in the vaporizing tubes C (II, 688). This was the result characterized by the patent claims as 'substantial vaporization prevented' in the B tubes,

as distinguished from the C tubes 'where vaporization takes place' (VII, 3091, claim 7).

These were the runs which demonstrated the Dubbs process as "new and revolutionary" (F. F. 23, VI, 3057; 40 F. Supp. 579; see also F. F. 12, VI, 3055).

The operations of this demonstration unit were under the supervision and control of the patentee, Dubbs, and were the basis of his patent application (I, 392-3), filed concurrently with the runs. The application, as we have shown, described a process wherein vapors were generated in the cracking tubes B, but "vaporization" (liberation of the vapors) took place only in the vaporizing tubes C.

The principle of the process carried out in the demonstration unit was embodied by Dubbs and petitioner in the so called "standard 500 bbls. unit" (Plate VII, Supplement), developed to carry out the Dubbs clean circulation process; these units became widely used by the industry under license from petitioner (II, 607-8, 611). In all of the licensed operations there was vapor *generation*, but not vapor *liberation*, in the cracking coil (B tubes), and there was vapor *liberation* in the separating chamber (vaporizing tubes C) (I, 514, 546; II, 599-601, 617, 688-94).

In the Independence demonstrations and in all the licensed operations, none of the residue of the process was cycled. Clean circulation was achieved.

Circumstances in the Oil Refining Industry When Dubbs Made His Invention

Several of the great refiners were working in the field when Dubbs appeared. As noted by Mr. Justice Brandeis in *Standard Oil Company* v. *United States*, 283 U. S. 163, at page 167, referring to January 1, 1921:

> "Meanwhile, since the phenomenon of cracking was not controlled by any fundamental patent, other concerns [than the Standard of Indiana] had been working independently to develop commercial processes of their own. Most prominent among these were the three other primary defendants, the Texas Company, the New Jersey Company, and the Gasoline Products Company."

And at page 175:

> "Up to 1920 all cracking plants in the United States were either owned by the Indiana Company alone, or were operated under licenses from it."

The application for the Dubbs patent in suit was, however, filed a year prior to the date as of which Mr. Justice Brandeis marshalled his facts for the above quotations. The inventor (Carbon P. Dubbs) had been literally born and brought up amid practical oil men, his father (Jesse A. Dubbs) having himself been an inventor and refiner who worked in the distillation and cracking arts (I, 391, 392). C. P. Dubbs was not affiliated with or financed by any great oil company (I, 376). The Universal Oil Products Company (petitioner herein), of which Dubbs "was quite a substantial stockholder" (I, 376, 392), and with which he was associated, was not itself a refiner or marketer of petroleum but was solely engaged in research and development in the field of oil technology (*ibid.*). It was as a small company, privately financed (I, 376), that it enabled Dubbs to make his discovery of the principle of "clean circulation" and to develop his operable process for its practice.

While Dubbs was working, the Standard Oil Company of Indiana was dominating the field, and The Texas Com-

pany, the Standard of New Jersey and the Gasoline Products Company, as well as other such companies as the Royal Dutch-Shell Group, Standard Oil of California, the Sinclair and the Gulf Companies, were spending millions of dollars and employing hundreds of men in cracking research and experiment. They were seeking one objective: to solve the carbon problem (F. F. 9, VI, 3054).

All these great companies had realized, of course, that a "batch" process was insufficient; they were searching for continuity of operation. In its simplest terms, every process which was being developed at the time of Dubbs' advent, in the hope of improving upon the Burton and Burton-Clark processes, evidenced the workers' conviction that it was desirable to have a circulation, or cycling, of the unconverted oil to the heating zone. Every such process dealt with: a feed of liquid oil to a tubular heating zone; cracking of the oil under heat and pressure, part of the oil being generated into vapor; releasing or liberating the vapors in a drum or shell; obtaining, through condensation of part of the released vapors, the ultimate end product known as "pressure distillate"; and returning part of the non-volatilized oil to the heating zone so that it might be run through or cycled again with the fresh feed. Such developments are exemplified by the Trumble process of the Shell Company (I, 508-9) and the Hanna and Richmond stills of the Standard Oil of California (II, 554; p. 14-5, *supra*).

The dominating thought was that a continuous run must be obtained by cycling round and round the oil unconverted to pressure distillate, including the unvaporized residue. The mechanical ingenuity of the industry was concentrated on the problem of how to build and adjust plants whereby this could be effected and yet the carbon problem avoided.

This record gives ample evidence that ingenuity of mechanics was being displayed to the full by the industry. Great refining companies were employing a large staff of engineers and chemists; were building small and large scale experimental plants (F. F. 20-2, 24, VI, 3056-7). There were naturally many variations in the particular types of plants, between the different companies and within each company. Yet all failed (F. F. 20, VI, 3056).

The Texas Company

The Texas Company was working on the development of a variant of the Burton process, known as the Holmes-Manley process, characterized by a vertical shell, heated in the middle part of its vertical walls, and by the return of the reflux condensate (or "backtrap"), as in Burton, to the heated cracking and vapor liberating shell, where it commingled with the residual oil (II, 977-8). It was not until long after Dubbs' advent that The Texas Company converted its Holmes-Manley stills to clean circulation (F. F. 26, VI, 3058).

Respondent's witness Behimer, who at the time here involved was one of The Texas Company's leading technologists testified (I, 327):

> "Following the work of my experimental plant in 1917 they built a commercial experimental plant which consisted of two and one stills, with three batteries, and later they built a pilot plant with four stills in order to test the commercial plant of twenty-four stills which they intended to build later. Those preliminary plants and the twenty-four still plant were known as Holmes-Manley, and not Behimer.
>
> "The Holmes-Manley type of plant did not incorporate the return of the reflux to the coil. It was not a clean circulation plant."

The Royal Dutch-Shell Group

The Royal Dutch-Shell Group was working under its Trumble patent 1,281,884 (issued to the Shell Company of California on October 5, 1918; I, 508). This development was under the direction of the witness, Daniel Pyzel. He witnessed a run of the operation of the Dubbs plant at Independence, at the end of 1918 or the beginning of 1919 (I, 505-507; F. F. 22, VI, 3056-7) and compared it with his own Trumble operations and with the Burton and Burton-Clark operations of the Standard of Indiana (I, 509). As to Trumble, he said (I, 510):

> "* * * after witnessing the operation of the plant in Independence, I realized that we had made in this work a serious mistake, which was the returning of the heavier residual liquids from the evaporator to the cracking tubes.
>
> "At the Dubbs plant at Independence such heavy residual liquid was not returned to the tubes, and only the raw oil mixed with the condensed heavy distillate entered those tubes. The result was that in the Dubbs plant at Independence the difficulties with coke forming in the tubes were very largely eliminated, but this same difficulty was practically the failure of our own efforts with the Trumble process."

The District Court found (F. F. 22, VI, 3056-7) that Pyzel, after

> "* * * he observed the operation of the Dubbs experimental plant at Independence, Kansas, * * * reported to his company that the Dubbs process eliminated the difficulties which Shell had formerly experienced in its efforts with the Trumble process."

He was candid about his own failure, and contemporaneously wrote to a senior officer of his Company, Mr. Van der Gracht (I, 510; PX 520, IV, 1729) that, although it was "more or less disagreeable" for him to say so, the Royal Dutch-Shell Group had been "beaten" by Dubbs, concluding (I, 511):

> "I take it that our company intends to act with complete fairness in this matter and would consider it unfair to follow the general method of working of the Dubbs process, circulating however a very small quantity of residuum in order to be able to call it a converter."

Pressed on cross-examination, Pyzel described his feelings when he saw the Dubbs invention in operation at Independence (I, 533):

> "And then when we saw this apparatus at Independence, Kansas, I said, 'My God, why didn't I think of that, to take that residuum out and have only clean reflux go back.' And that is the reason that we wanted to make the agreement with Dubbs, and that is why I expressed in that other letter in which I said, 'Well, we ought to recognize that we have been beaten by Dubbs.' That was the only thing, but in our various experiments we tried to increase that gasoline production."

It is a reasonable inference that this world-wide group of petroleum companies would not have accepted a license, compelling the payment of current cash royalties to a little group at Independence, Kansas, unless they were absolutely convinced of the necessity therefor (F. F. 20, VI, 3057). Indeed Pyzel's contemporaneous letter to Van der Gracht recognized this factor of pride so difficult to swallow (I, 511):

> "Therefore, I can only say that, as far as the cracking of gas oil into gasoline is concerned, we are already beaten in advance, and I think it is better to acknowledge this, than to hang on to a lost cause for sake of personal or 'company' pride."

The Standard Oil Company of California.

While Dubbs was making his invention and filing the application for his patent, Standard Oil Company of California was working under license from Standard Oil of Indiana for the Burton and Burton-Clark processes (II, 553-4). The work was in charge of the witness, Richard W. Hanna, vice-president of the California Company (II, 553-5). He found by experience that the Burton process was unsuccessful in that the cost of production of gasoline (25¢ per gallon) was excessive (II, 554),* and that the Burton-Clark process was likewise "not a practical commercial operation for us" (II, 554), as "The total cycle did not exceed 60 hours, with a thirty-six hour production period, the balance consumed in cleaning the tubes and shell, starting up and shutting down" (II, 554). The license from Standard of Indiana also "included the right to operate under all of the Texas Company patents" (II, 554) (*cf. Standard Oil Company* v. *United States,* 283 U. S. 163, 168); but The Texas Company rights did not help solve California's problem.

California employed some 200 technicians and had spent upwards of $5,000,000 on experimental work (II, 554, 564). After the Burton-Clark process, it then experimented with the so-called Hanna stills, built 35 of them, but found

*The California Company was working with a heavy type of gas oil.

them likewise "not commercial" (II, 554), and then turned to the so-called Richmond stills (see p. 30, *supra*); but again there were "not commercial" (II, 554). "This was in 1923" (II, 554). Thus, four years after Dubbs had demonstrated his work to the Royal Dutch-Shell and to the Mid-Continent refiners, the Standard Oil Company of California was still struggling with the problem, without being able to attain a commercial result; yet "At this time we had spent upwards of five millions of dollars and employed around two hundred technical men in experimental and laboratory work in an attempt to solve our cracking problems. The cost of maintaining this laboratory was a million dollars a year, and I had the full responsibility" (Hanna: II, 554-5).

It was at this point that California's engineers visited the Dubbs unit operated by Shell at Martinez, California, "'and there observed absolutely clean circulation, and we immediately realized that is what we were after and started to work on that line of development' " (II, 555).

There is likewise a letter in the record from Hanna to one of his associates in which Hanna, dealing with the engineers' report of their visit to the Dubbs plant, said (PX 533, II, 555):

> "In studying over these reports, it would seem to me that we have picked up the following:
>
> "First: Cleanliness is next to godliness.
>
> "Second: That the Dubbs people anticipate us in appreciation of cleanliness."

Reception of Dubbs by the Industry

Royal Dutch-Shell Group

The first Dubbs license was issued to the Royal Dutch-Shell Group on December 12, 1919 (PX 521A, IV, 1734),

and set the model for Dubbs' licenses. *It contained no provisions for restrictions of territory, for control of price or marketing conditions.* It set a fixed royalty of 15¢ per barrel of through-put and then licensed the Royal Dutch-Shell operating subsidiary (Roxana Petroleum Company) under all of the patents and applications for patents of the petitioner. The Shell people made it plain, however, that what they were primarily seeking in the license were rights under the Dubbs patent in suit (I, 523).

Standard Oil of California

When Standard of California first became aware of the clean circulation principle in operation at the Shell plant at Martinez (II, 555), it did not realize that it needed a license for the use of the process. But the issue of the Dubbs "overhead feed" patent No. 1,488,325 (VII, 3416) in March 1924, put the California people on notice that there was patent coverage of clean circulation and caused a patent search to be made. Hanna described what followed (II, 555-60): "As a result of that investigation, Lyon and Lyon, our patent attorneys, brought to our attention an earlier patent, Dubbs 1,392,629, issued October 4, 1921 [the patent in suit]" (II, 556). The '629 patent was then in interference with the Behimer application; Messrs. Lyon and Lyon made an independent study of the interference and recommended that a license under the Dubbs patent be obtained from Universal (II, 557, 580).

Like the Royal Dutch-Shell people, the Standard Oil of California at once concluded that honesty required them to seek a license. "We sent for Mr. Halle* who

*President of the petitioner.

arrived in July 1924. We spent several weeks trading and negotiating" (II, 557). Hanna testified that he attempted to obtain the rights only under the Dubbs patent in suit and the other Dubbs patent (No. 1,488,325) but eventually accepted one of petitioner's standard license agreements (II, 557). He did so "with our eyes open as to the cost" (II, 581).

Royalties Paid by Shell and Standard of California

By 1930 the Shell people were paying royalties of the order of $2,000,000 per annum net (I, 524). In 1931 they paid $7,500,000 for a fully paid-up license for future operations (I, 523-4; II, 598) and invested a further $3,000,000 in notes of Universal.

The royalties paid to Universal on a through-put (fresh oil charged) basis by Standard of California amounted to $2,500,000; and in 1931 California paid $3,000,000 more for a fully paid-up license covering future operations (I, 254; II, 598, 560).

The 1931 payments by Shell and Standard of California were part of a transaction by which the stock of Universal was purchased by them, and a settlement made of the pending patent litigation with several other large refining companies (I, 524).

Independent Refiners

After the Royal Dutch-Shell Group had taken a license in 1919, Universal, having designed standard Dubbs units, made the rights under the Dubbs patent and improvements thereof available to everyone in the industry. Prior to the installation of the accused Winkler-Koch (Globe) process, Universal's licensees had over 256 units in operation for practicing the Dubbs process; these installations cost the

licensees nearly $46,000,000 and had processed over 190,000,000 barrels of oil (PX 586, 587, IV, 1818-22). This covers the period 1922-1929. In 1922 there was one licensee with two units; in 1923 there were 20 licensees with 71 units; and in 1929, 49 licensees with 214 units. The exhibits just cited give the names of the licensees, and the numbers and capacities of their units. These included refineries in fourteen different states and in fourteen foreign countries. The licensees within the United States included 32 independent refining companies in addition to the companies of the Royal Dutch-Shell Group and the Standard of California (PX 587, IV, 1820-2).

This policy of Universal,—to license any refiner, and all at a uniform royalty, and without limitation as to sales price of product, territory of sale, or marketing terms,—remained in effect throughout the life of the patent in suit. Every Universal license was granted under all patents and patent applications, present and future, owned or controlled by Universal in the licensed field.

Abstracts of exhibits placed in the record show that the grand total of royalties paid to petitioner from 1922 to December 31, 1930, by the Shell Group and the Standard Oil of California was $17,146,004.36, and by 37 domestic and 11 foreign licensees, during the same period, $16,430,492.04 (II, 597).*

The royalty rate fixed by Universal at the time of its first comprehensive license was 15¢ a barrel through-put. This was reduced by the company in 1934 to 10¢ a barrel, *and upon the expiration of the 1,392,629 patent in suit was reduced to 5¢ a barrel, effective October 1, 1938* (II, 596).

*The abstract of PX 572 in II, 597, is in error in attributing the grand total of $33,576,496.40 to the Royal-Dutch-Shell and Standard of California only.

Conflicts of Universal with the Standard Oil Companies of Indiana and New Jersey

Standard of Indiana abandoned the Burton-Clark stills in favor of the clean circulation process. It called its clean circulation units "Holmes-Manley", which was the name given by The Texas Company to the units that it had developed, and in which, long after the Dubbs demonstration runs, it had applied the clean circulation principle. The Texas Company had thereafter licensed the use of these units to the Standard of Indiana (under the agreements which were the subject-matter of the anti-trust suit in *Standard Oil v. United States*, 283 U. S. 163). These "Holmes-Manley" units were first installed by the Indiana Company at Whiting in 1924 (I, 490); and the last Burton tube stills (Burton-Clark) at Whiting were discontinued about 1928 or 1929 (I, 503).

Meanwhile, on January 28, 1926, Universal had brought suit against Standard of Indiana (PX 567; IV, 1790) on the Dubbs patent and several improvement patents.

On April 11, 1930, Universal also brought suit against Standard Oil Company of New Jersey for infringement of the Dubbs patent in suit and various improvement patents (PX 568; IV, 1791).

These suits, as well as certain other litigation, were all settled in 1931 by cash payments to Universal (I, 524; II, 560, 598).

Conflict with The Texas Company

When Dubbs made his invention The Texas Company was developing a process which was a variant of the Burton process and did not embody clean circulation (p. 31, *supra*). But it had filed, in the names of Holmes,

Manley and Behimer, an application covering the clean circulation principle, although it did not know how to work it (F. F. 26, VI, 3057-8). The names of Holmes and Manley were later withdrawn, and Behimer's name stood alone upon the application. In 1923, the Behimer application went into interference with the already issued Dubbs patent. The interference proceedings were continued from 1923 to 1931, when they were settled through a disclaimer by Behimer of the broad claim to the invention of the clean circulation principle and his retention of narrower claims to the operation of that principle with the use of a pump (PX 829; IV, 1868). Upon these narrower claims, Behimer's patent No. 1,883,850 (VII, 3494) was issued in 1932.

The Behimer patent will remain in effect until 1949; whereas the Dubbs patent in suit expired in 1938.

The Winkler-Koch Group (including the respondent Globe)

Respondent is a commercial refiner. The accused Winkler-Koch process was practiced at its refinery at Lemont, Illinois (I, 473).

In an industry with as many independent concerns as exist in oil refining, it is not surprising that there were exceptions to the general rule of universal recognition of the Dubbs patent. It was, however, only a limited group of companies in the industry that set out actually to "pirate" the Dubbs process,—to use the Dubbs invention but not to acknowledge it. These companies were grouped together in a "Patent Club" under the aegis of former employees of petitioner itself,—"post-graduates of Universal" (as they described themselves; II, 632), who had

formed the Winkler-Koch Engineering Company which designed or built plants for the respondent Globe Company, for the defendant in the Third Circuit (Root Refining Company), and for several other companies (I, 44-51). From the outset each of the members of this Patent Club contributed to a common fund with which to retain lawyers and experts for defense in litigation (I, 40-51).

The accused process is the same as that which was involved in the *Root* case. It is illustrated in Plate V of the Supplement (PX 508, IV, 1705), is described in detail by petitioner's expert Dr. Brown (II, 682-7). And its operation has been stipulated in this case (I, 473).

Application of the Dubbs Claims to the Accused Operation

In determining infringement of the Dubbs patent, it will suffice to consider claim 7 only, which has been treated as typical of those in suit (Dis. Ct. Op. VI, 3038; C. C. A. Op. VII, 3577).

This claim is broken down below into its several steps; and the respondent's operation is described by reference to Plate V.

"A process of cracking oil",

The accused process is a cracking process.

—"consisting in continuously passing a stream of oil through a series of tubes seated in a cracking zone"

The stream of oil is the mixed feed drawn from the bottom of the partial condenser or "bubble tower" by a high

pressure pump, which forces it through a pipe comprising a series of tubes located in the "high pressure furnace" shown at the left hand side of plaintiff's Exhibit 508 (II, 760; IV, 1705; Plate V.). The furnace chamber in which these tubes are located constitutes a cracking zone. On Plate V the mixed feed is shown by the horizontal line colored green and red near the bottom of the Plate.

—"where the oil is heated to the cracking temperature but substantial vaporization prevented"

The oil in its passage through the pipe coil in the high pressure furnace is heated to a temperature of 940° F. This is a cracking temperature. In the pipe coil, vapors are generated, but the *liberation* of the vapors from the non-volatilized oil is prevented (II, 682-3; 724).

—"thence to an enlarged vapor chamber where vaporization takes place"

The oil passes from the pipe coil in the high pressure furnace into the separator, or vaporizing chamber, which is 8 feet 6 inches in diameter and 41 feet 3 inches in height. There, at a point about 20 feet above the bottom of the vaporizing chamber, the vapors liberate themselves from the foamy mass issuing from the cracking tubes of the pipe coil and rise into the upper part of the vaporizing chamber (III, 1158-9).

—"removing the vapors from said chamber"

In the accused process the vapors pass from the top of the separator (through "heat exchangers", not material to the present controversy) into the "bubble tower", shown at the right central portion of Plate V (III, 1159).

—"subjecting them to an initial condenser when a portion of the vapors are condensed"

This occurs in the "bubble tower" (the name used by the accused process for the initial condenser). There part of the vapors which come over from the separator are reduced to liquid and form the "reflux condensate", which flows by gravity to the bottom of the bubble tower (III, 1159).

—"subjecting the uncondensed portion of the vapors to a final condensation"

The vapors not liquefied in the partial condenser or bubble tower leave the top thereof and flow into the final condenser shown at the right hand side of Plate V, which effects the final condensation of such vapors into "prossure distillate" (III, 1159).

—"returning the condensate from said initial condensation to the inlet side of the cracking tubes"

The reflux condensate passes from the bottom of the "bubble tower" through a pump—(as shown by the red part of the red and green colored line near the bottom of Plate V)—into the entrance end of the pipe-coil in the high pressure furnace, through which it is cycled for further cracking (III, 1160).

—"continuously drawing off the residue from the vapor chamber and preventing it from returning to the cracking zone"

The residue from the vapor separating step occurring in respondent's "separator", or vaporizing chamber, flows from the bottom of the latter through a cooler to storage.

It is not cycled to the pipe coil in the high pressure furnace (III, 1160).

—"maintaining a pressure on the oil during treatment".

In defendant's operation a superatmospheric pressure is maintained in the oil during treatment. The pressure varies from approximately 660 pounds at the inlet to the pipe coil in the high pressure furnace to 16 pounds in the final receiver for the pressure distillate. In the partial condenser it is 24 pounds, and in the vapor separator it is 26 pounds.

The Egloff Patent

The policy of Universal Oil Products Company, as already described, was to continue with research and development designed to develop and improve the Dubbs process. In the course of that work, various improvement patents were from time to time granted to Universal, all of which Universal immediately made available to all of its licensees without any additional charge of any sort (see *e.g.*, I, 557). The licensees were free to use or not to use the various improvements* as they saw fit. Some were used; many were not. Different plants used different improvements, although all of them were based on the principle of the Dubbs patent.

So of infringers. They use the Dubbs patent. Some used certain improvements, and others, others. Some members of the Winkler-Koch Patent Club, Root and Globe among them, used the Egloff improvement in suit.

*For a description of some of these improvements, other than Egloff, see II, 609-11.

There is no claim that this patent was revolutionary. But the petitioner does claim that the invention is beneficial, as is perhaps best evidenced by the simple fact that respondent used it. It not merely has utility; it has novelty; it provided a new and original conception of improving the quality of the raw oil which is fed to the Dubbs clean circulation process.

Claim 2 of the Egloff patent, which was taken as typical in the District Court, reads as follows (VII, 3096):

> "2. A process of oil conversion, consisting in maintaining a body of heated hydrocarbons in an enlarged zone where substantial vaporization occurs, in subjecting the vapors to reflux condensation to condense the heavier fractions of the vapors, in passing reflux condensate in an advancing stream through a heating zone where it is subjected to a cracking temperature, in delivering the heated condensate to said enlarged zone, in simultaneously heating an independent stream of charging stock to a cracking temperature while under a superatmospheric pressure, in introducing said heated charging stock to said enlarged zone in which zone the charging stock and heated condensate physically commingle, and in maintaining the stream of reflux condensate while being heated under a superatmospheric pressure exceeding the pressure maintained on the stream of charging stock."

The apparatus of the Egloff patent (VII, 3095) is illustrated in Plate IV of the Supplement. When Egloff entered the field, the Dubbs process was in use. But Egloff realized that some oils were particularly rich in potential carbon forming materials and were, therefore, not as favorable a feed stock for the Dubbs process as other oils, al-

though usable therein. Egloff invented a process which involves integrating with the Dubbs process a preliminary step, whereby, at a minimum installation and operating cost, these less desirable oils are transformed in considerable part into cracking stock or "fresh feed" more suitable for drastic cracking in the Dubbs process (II, 666-7). To this end Egloff provided a low temperature, low pressure coil (7),* through which the less desirable oil is passed, for effecting a mild cracking. The oil thus treated then joins the stream from the high temperature, high pressure coil (6) ["cracking tubes B" of the Dubbs unit], and the two, intermixed, are discharged into a single vaporizing chamber (12) ["vaporizing tubes C" of the Dubbs unit]. The common residue is drawn off from chamber (12) and not cycled. The vapors liberated from the mixed stream in the vaporizing chamber pass off into an initial condenser (21). The condensate formed in the initial condenser (21) from the vapors emanating from the oil charged to the low temperature coil (7) constitutes the fresh feed for the coil (6), and the condensate formed in the initial condenser from the vapors of the oil that has passed through the high temperature coil (6) corresponds to the "reflux condensate" of the Dubbs process. The fresh feed and the reflux condensate thus formed pass together through the high temperature coil (6) and thereafter follow the course above described. The vapors passing from the initial condenser (21) follow the course hereinabove stated in describing the Dubbs process (II, 667-9).

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*The numbers in the above paragraph correspond to those used in the patent. See Plate IV, Supplement.

The preliminary treatment of the less desirable oil by distillation accompanied by mild cracking in coil (6) and chamber (12) creates a more desirable distillate oil for use as charging stock in the Dubbs part of the combination.

Thus the Egloff invention is an important improvement over Dubbs in that it preliminarily treats, screens or cleans the raw oil before it travels to the Dubbs part of the unit and permits cracking of the oil under conditions more advantageous to its characteristics, with better results than if the less desirable oil were charged directly to the high temperature coil of the Dubbs part of the combination.

Respondent's expert Smith, in describing respondent's operation, attributed to it the very characteristics and advantages of the Egloff combination (III, 1123):

> "In the low temperature, low pressure furnace we charge a topped crude, and in the high temperature, high pressure furnace we are charging a clean gas oil stock. The reason for that distinction is that the topped crude would not be suitable for charging to this high pressure furnace and for subjection to the conditions prevailing in there because the topped crude contains so much of this dirty asphaltic material that if it were cracked to the extent that the oil is cracked in the high pressure furnace it would very quickly fill up some of the tubes with coke and our operation would have to be shut down.
>
> "If topped crude were fed to this cracking furnace, then to operate it successfully we would either have to operate with a very short run or we would have to alter the conditions so that we would not crack nearly so much of the material into gasoline."

Application of the Egloff Claims to the Accused Operation

In determining the infringement of the Egloff patent, it will suffice to consider claim 2.

This claim is divided below into its several steps, and after each is given the corresponding step of the accused process. In this explanation reference is particularly made to plaintiff's Exhibit 508 (Pl. V of the Supplement). Thus:

"A process of oil conversion"

Defendant's process is a cracking process.

—"consisting in maintaining a body of heated hydrocarbons in an enlarged zone where substantial vaporization occurs"

In defendant's operation the enlarged zone is provided by the 8′ 6″ x 41′ 3″ vessel designated "separator."

The body of heated hydrocarbons is the column of foam about 20 feet deep in the bottom of this separator which contains 16 barrels of liquid oil and vapors. Cracking occurs in the separator resulting in the formation of vapors, and producing 105 barrels of gasoline per day (II, 671). The vapors thus generated are separated from the oil. Consequently, there is "substantial vaporization" in the separator.*

—"in subjecting the vapors to reflux condensation to condense the heavier fractions of the vapors"

*This is so, whether the word "vaporization," as used in the *Egloff* patent, be deemed to mean vapor generation or vapor separation, since both phenomena occur in respondent's separator. Consequently the Egloff claims do not present the same issue as the Dubbs claims.

This occurs in the "bubble tower". The heavier parts of the vapors are there liquefied to form condensate.

—"in passing reflux condensate in an advancing stream through a heating zone where it is subjected to a cracking temperature"

The condensate formed in the partial condenser or "bubble tower" is withdrawn from the bottom thereof and is forced by a feed pump into and through the pipe coil in the "high pressure furnace" shown on the lower left corner of Plate V, where the oil is heated to a drastic cracking temperature, 940° F., under a pressure upwards of 500 lbs. per square inch.

—"in delivering the heated condensate to said enlarged zone"

The condensate aforesaid passes from the pipe coil in the high pressure furnace through a transfer line colored red on Plate V into the "separator" aforesaid.

—"in simultaneously heating an independent stream of charging stock to a cracking temperature while under a superatmospheric pressure"

This occurs when the topped crude stream is pumped through the low pressure pipe still (under the flap attached to Plate V) under a pressure of 260 pounds per square inch, as indicated by a green line on Plate V of the Supplement. The oil is heated during its passage through this pipe-still to a cracking temperature (720° F.) and is further heated by contact with the hotter stream from the companion high pressure pipe-still, when the streams from the two furnaces mix together.

—"in introducing said heated charging stock to said enlarged zone in which zone the charging stock and heated condensate physically commingle"

The independent stream of topped crude charging stock initially heated as stated passes through the transfer line colored green in Plate V of the Supplement. After confluence thereof with the oil flowing through the (red) transfer line from the high pressure furnace, the two streams commingled pass into the "separator" as indicated by the green and red line leading to the separator on Plate V.

—"in maintaining the stream of reflux condensate while being heated under a superatmospheric pressure exceeding the pressure maintained on the stream of charging stock"

Plate V shows that in respondent's operation the minimum (outlet) pressure on the condensate stream, while being heated in the high pressure pipe still, is 500 pounds which exceeds the maximum (inlet) pressure of 260 pounds on the crude oil stream passing through the low pressure furnace.

V

OPINION, FINDINGS OF FACT, AND CONCLUSIONS OF LAW OF THE DISTRICT COURT ON THE ISSUE OF VALIDITY

(*i*) *Conclusions of Law*

The ultimate conclusions of law of the District Court were that the Dubbs patent is valid, and that the Egloff patent is invalid for lack of invention and for lack of utility (C. L. 2 and 12, VI, 3060, 3061).

(*ii*) *Findings of Fact on Validity of Dubbs*

The relevant findings of fact of the District Court on validity (VI, 3052-3058) are:

The Burton and Burton-Clark processes of the Standard Oil Company of Indiana, constitute the state of the art as practiced commercially when Dubbs appeared on the scene (F. F. 9).

Burton had several disadvantages:

(1) That it required a 24-hour shutdown after only a 24-hour "on stream"; (F. F. 5-6)

(2) That the accumulation of carbonaceous material [coking] within the wall and on the bottom of the shell caused "hot spots" to appear with resulting explosions, causing loss of life and property damage; (F. F. 7-8)

(3) That only about 28% of the total charge in the Burton process was recoverable as gasoline, although the process required "a clean gas oil stock" as a charge. (F. F. 7-8)

Burton-Clark, although an improvement over Burton, had similar disadvantages:

(1) That it also operated only 36 hours "on stream" and then had to be shut down for 36 hours;

(2) That otherwise the "hot spots" would result from the accumulation of carbon [coking] (F. F. 7-8).

This left the problem to be solved—to crack the heavier hydrocarbons to produce gasoline without coking up the vessel in which the cracking occurred (F. F. 9).

Dubbs solved the problem (F. F. 9).

The District Court then described the operation of the Dubbs process as he understood it (F. F. 10), and its results,—that the deposition of carbon and carbonaceous material resulting from the cracking operation occurs in a safe place, and the carbonaceous residue is then withdrawn, and the reflux condensate is not returned either to the shell or to the C tubes containing the carbonaceous residue but is returned to the entrance end of the B tubes with the fresh feed, enabling the operator to operate the apparatus for a long period of time as was shown in practice in a demonstration run at Independence, Kansas [in 1919] when the system remained "on stream" nine days and was shut down then because the oil men who came to witness the demonstration said they were satisfied (F. F. 11).

The Dubbs process was recognized immediately by the larger oil companies as a great improvement in the art and the older processes of producing gasoline were practically abandoned (F. F. 12).

The Dubbs process taught what is known as the principle of clean circulation (F. F. 13).

The District Court then considered the teachings of six patentees that had been put forward by the respondent as constituting prior art, and concluded as to each of them that they do not teach the clean circulation process to those skilled in the art (F. F. 13):

(1) *Pielsticker* does not disclose return of clean reflux unmixed with residue to the heating tubes, and, indeed, it appears to be nothing more than simple distillation (F. F. 14).

(2) *Hall* describes a vapor phase process, a process negatived by Dubbs, does not teach a cycling process at all, and although tried out by The Texas Company, proved unoperable (F. F. 15).

(3) *Ellis* discloses a vapor phase process and does not teach recycling of the reflux, and, indeed, the construction of the system prevents the return of reflux condensate to the heating tubes (F. F. 60).

(4) *Alexander* is very confusing in its description and claims, does not teach the Dubbs process, and, indeed, was proven in practice to be of no practical use because the Gulf Oil Company experimented with at least one of its variations at a cost of $1,500,000, with resulting failure (F. F. 17).

(5) *Biddison and Boyd* teaches three systems, of which the one asserted to anticipate Dubbs is not clear, but is, in any event, a vapor phase system and does not teach a circulation with return of clean reflux to the cracking tubes (F. F. 18).

(6) *Greenstreet* does not disclose the return of clean reflux, for the reflux contains the carbonaceous residue (F. F. 19).

That the prior art did not teach clean circulation is shown by the fact that the great oil companies such as Texas, Gulf, Shell and the Standard Oil Company of California, with their staffs of highly trained technical experts, never discovered this principle in the prior art (F. F. 20).

The findings then reviewed, as we have already done, the failures of those companies in detail,—Standard Oil Company of California (F. F. 21) and the Royal Dutch-Shell Group (F. F. 22).

The findings of fact up to this point follow the opinion almost verbatim (*cf.* Op., VI, 3035-3040), and thereafter the opinion considers in detail, along the same lines as our statement of facts above, the failures of the Standard Oil Company of California, and the Royal Dutch-Shell Group (VI, 3041-3043).

As to commercial success, the District Court found that practically all of the large refining companies took out licenses under the Dubbs patents comprising the patents in suit and certain other patents and paid millions of dollars in royalties for the privilege. This is more than commercial success. Here the recognized experts in the art saw the Dubbs process as new and revolutionary and no one was better qualified (F. F. 23).

The District Court then reviewed in detail the contention of respondent that Dubbs was anticipated by Behimer, then an employee of The Texas Company. Experimental plants were erected by The Texas Company but abandoned. Behimer did not know of any means of returning the reflux to the heating coils (F. F. 24). His testimony that he had the idea of returning reflux by hydrostatic pressure is uncorroborated and is negatived by the drawings of The Texas Company (F. F. 25). The Behimer application, caused to be filed by The Texas Company four months earlier than Dubbs, was a paper application, as Behimer had not conceived the workable process (F. F. 26).

Dubbs succeeded where Behimer failed, and the success, involving the return of the reflux by hydrostatic pressure, did not involve mere mechanical skill on Dubbs' part; Behimer's failure was due to a fundamental defect (F. F. 27).

(iii) Findings of Fact as to Egloff.

As to Egloff, the District Court contented itself with finding that the evidence does not disclose any benefit resulting from the separate treatment of the reflux in the patent (F. F. 37) and that the patent was never used commercially (F. F. 38).

In these findings the Court was clearly wrong, as the respondent itself unquestionably uses Egloff commercially in the accused process and the benefit which respondent derives from that use is proven.

(iv) Relation of the District Court's Findings in Favor of the Validity of Dubbs to the Issues Presented on This Appeal as to the Infringement of Dubbs

On the question of validity of the Dubbs patent, therefore, the District Court had found that its *novelty* was so great as to merit the adjective "revolutionary" and that its *utility* was so great that it solved the problem which none of the great companies of the oil industry had been able to solve.

The District Court then turned to the issue of infringement. No finding was made that the accused process avoids infringement of the Dubbs patent, except upon the ground that the phrase in the Dubbs claims relating to "substantial vaporization" in the B tubes must be construed as meaning that any substantial *generation* of vapors was inhibited by Dubbs in the B tubes. The consequence is that the accused process, while following closely the teachings of this revolutionary and useful invention, escaped infringement because its necessary *generation* of vapors in the B tubes was not covered by the words of the Dubbs claims, construing them as the Court construed them.

As this was the sole issue considered in the opinion of the Circuit Court of Appeals, and upon which in consequence the judgments both of the District Court and the Circuit Court of Appeals were based, it will be the issue upon which we will submit a more extended "Argument" in this brief. It is appropriate, therefore, that we defer

consideration of the findings of fact and conclusions of law of the District Court on this issue until the argument.

We will content ourselves here by pointing out that the findings of fact and conclusions of law of the District Court are in this posture: that they break into two clear halves. In the first of these the Court gives convincing reasons to support its own conclusion that the Dubbs patent is a patent of most unusual quality, but in the second, the Court proceeds to determine the question of infringement as if the first half of the opinion and the first findings of fact and conclusions of law had never been written.

VI

SPECIFICATION OF ERRORS

The errors assigned appear at pages 28-31 of the petition. All of them are relied upon. Nos. 1 and 2 are formal. Nos. 3 to 17 inclusive deal with various aspects of the opinion of the court below in its treatment of the question of infringement of the Dubbs patent. Nos. 18 and 19 deal with the Egloff patent.

VII

SUMMARY OF ARGUMENT

The Dubbs Patent

Respondent does not contend that the accused process was designed from any inventions of its own. It cannot seriously contend that its process stemmed from the prior art. It was sponsored by the Winkler-Koch Engineering Company, of which two officers (Winkler and Perdew) had been employees of the petitioner and fully advised of the Dubbs process; they styled themselves "post-graduates of Universal". Respondent has not disputed that the accused process embodies "clean circulation" which vitalizes the Dubbs invention.

The Circuit Court of Appeals conceived, however, that a phrase used by Dubbs in his claims, with respect to what Dubbs calls the "cracking tubes" or "cracking zone" (*i.e.*, the B tubes), is defined in the dictionaries in such a way as to exclude from the scope of the patent claims any process in which cracking, accompanied by vapor generation, occurs in what Dubbs calls the "cracking tubes" or "cracking zone":

The phrase in the claims is "without substantial vaporization" (or equivalent words), and the definition relied upon is that vaporization means any generation of vapors. Respondent says, and the courts below have acquiesced, that no cracking process in which vapors are generated in the heating and cracking tubes infringes Dubbs.

If, as petitioner contends, the phrase prohibits the liberation of vapors but not the generation thereof in the B tubes of the Dubbs process, then the Dubbs claims read upon respondent's process as stipulated in this case.

It is settled law that a patent must be construed as a whole and the claims read in the light of the specifications and drawings. The Dubbs patent, so read, cannot properly be construed except as petitioner contends. It rejects respondent's contention that the word vaporization as used in the patent inhibits vapor generation. *Smith* v. *Snow*, 294 U. S. 1.

Some dictionaries give to "vaporization" the meaning contended for by respondent, *i.e.*, generation of vapors. Others give it the meaning that Dubbs intended, viz. *liberation* or *separation* of the vapor from the liquid within which the vapor has theretofore been generated. Others again give it both definitions for, indeed, vaporization is not complete or useful until the vapor has been liberated or separated from the liquid oil.

We think the Dubbs patent compels the adoption of the second meaning, *i.e.*, liberation of vapor. We do not contend that dictionaries or encyclopedias or scientific works compel the exclusive use of the second meaning. We do not admit the position of the Circuit Court of Appeals that they compel the exclusive use of the first meaning. And we submit that the true view is that both meanings are permissible, and that in ascertaining which was used in a particular patent, the principles of *Smith* v. *Snow*, 294 U. S. 1, must govern.

To determine the meaning of the word "vaporization" in the Dubbs claims, we turn, therefore, in the argument to an extended analysis,

First, of the patent itself, in which Dubbs distinguishes the "cracking tubes" B (where, under his teaching, "substantial vaporization" is not to take place)

from the "vaporizing tubes" C located in the "vaporizing zone";

and in the operation of which generation of vapor must inevitably take place in the cracking tubes B;

and in which Dubbs refers to the fact that a "per cent of vapors" is generated within the C tubes, the balance of the vapors being obviously generated in the B tubes;

and in which Dubbs gives an illustrative run with temperatures from 750° to 860°, at 100 pounds pressure, as to which petitioner's expert testified that vapor generation in the B tubes is compelled by the immutable laws of physics, and respondent's expert admitted that generation must occur, at least within the upper range of the temperature zone specified;

and in which Dubbs describes what transpires in his C tubes as a "liberation of vapors", and also describes it by saying that "vaporization takes place" therein, the quoted phrases being obviously used in the same sense, wherefore in the description of C tube operations "vaporization" means "liberation of vapors";

and in claims of which Dubbs refers to "a vaporization space above the stream" of liquid oil in the C tubes, which obviously must be a space to which the vapors move after liberation or separation,—and the patent so states, viz. that it is in the C tubes "that vaporization takes place";

and in claims of which there is the step of "removing the residue [from the C tubes] after said vaporization", plainly connoting that vaporization as there used means liberation.

Second, of the original claims, in which Dubbs recited "passing the oil *and generated vapors*" from the B tubes into the C tubes,—which original claims were later canceled by an amendment inserting the aforesaid illustrative run defining to the skilled in the art the same subject matter with respect to the conditions existing in the B tubes, which subject matter therefore remained continuously before the Patent Office.

Third, of the actual demonstration runs made by Dubbs just prior to, and contemporaneously with, the filing of his application (a) for the witness Daniel Pyzel, in charge of refinery operations in the United States for the international group of Royal Dutch-Shell companies, and (b) for a group of refiners representing the National Petroleum Association and the Western Refiners Association, in both of which runs there was copious generation of vapor in the cracking zone (the B tubes), but in which, in accordance with the teachings of the simultaneously filed application, there was no liberation or separation of vapor until the vaporizing chamber (C tubes) was reached.

Fourth, of the commercial "standard 500 barrel units" licensed by the petitioner under the Dubbs patent, 256 in number between 1922 and 1929, in 49 different refineries, in all of which the same phenomena occurred in the B tubes as in the demonstration runs.

Fifth, of the fact that Dubbs had spent his lifetime in the petroleum art and that his patent disclosure is addressed to others skilled in the art, and that to adopt respondent's contention is to make Dubbs look ludicrous because he would have excluded from the operation of

the cracking tubes of his demonstrated process the vapor generation which he and others skilled in the art knew to be inevitable.

Sixth, of the file wrapper history, which shows that the disputed phase was not inserted in the Dubbs claims to avoid the prior art, and that Dubbs distinguished from the latter by the non-cycling of any of the residue through the B tubes i.e., clean circulation, and which shows the adherence by Dubbs to his conception of the word "vaporization" as teaching to the skilled in art the liberation or separation of vapors from the liquid oil, and none of which calls into play in any way the principles of file wrapper estoppel; *cf. Schriber-Schroth Co.* v. *Cleveland Trust Co.,* 311 U. S. 211.

Seventh, of the principles of law, recently summarized and restated in *Smith* v. *Snow,* 294 U. S. 1, under which Dubbs' invention, constituting (as the District Court found and as was the fact) a revolutionary and constructive advance in the art, is entitled to a liberal construction of the claims and is such a meritorious invention that, if the claims be fairly susceptible of two constructions, that should be adopted which will secure to the patentee his actual invention, rather than to adopt a construction fatal to the grant.

Eighth, of the knowledge had at the time of the Dubbs patent by those skilled in the art, which, as indeed was laid down in express terms in Trumble 1,281,884, granted the previous year, was that in the heating zone the vapor remains intimately *mixed with the body of the oil* due to its rapid motion and high velocity *forming a foam.*

Ninth, of the expert testimony establishing that if Dubbs is operated in the manner taught by the specifications "you inevitably get that condition", "you can't help yourself", and the principle of velocity to attain the condition "was well appreciated" in the art.

The opinions of the District Court and the Circuit Court of Appeals in the *Root* case (6 F. Supp. 767, and 78 F. (2d) 996-9) correctly grasped these points; but the learned courts below fell into error upon the following grounds:

1. The District Court

(a) found that no cracking takes place in the B tubes and that, therefore, no generation of vapors takes place therein. The finding that no cracking takes place in the B tubes was erroneous on the facts. Petitioner's expert explained that the Dubbs patent itself plainly taught cracking in the B tubes, and that by the laws of physics governing the operation taught by the Dubbs patent, cracking and vapor generation must necessarily take place in the B tubes at the temperatures and pressure specified by Dubbs. Even respondent's expert was compelled to make the same admission in respect of the upper part of the temperature range specified by Dubbs; and in respect of the lower part of the temperature range he was required, in order to support the meaning ascribed by him to the word "vaporization", to depart from the teachings of Dubbs.

(b) The learned District Court next ventured the thesis that Dubbs himself had no clear idea of

what was happening in those tubes. But this theory, inherently most unlikely, becomes entirely unreasonable when one recalls that Dubbs himself was giving practical demonstrations of his process at the time that the original application was filed; that in those demonstrations copious generation of vapors always occurred in the B tubes; and that in the original application he specifically mentioned the passage of "generated vapors" from the cracking tubes B to the vaporing chamber or C tubes. The same teaching was given to the man skilled in the art by the illustrative run incorporated in the patent prior to the presentation of the claims of the patent.

(c) As to the original claims the District Court erroneously found that Dubbs could derive no benefit therefrom in construing the word vaporization because these claims, although concededly a part of the original disclosure, were subsequently canceled. The Court overlooked the fact that the same subject matter was carried through from the time of the cancellation of the original claims, by the insertion of the illustrative run.

(d) To the illustrative run, the District Court interposed the reciprocally untenable objection that it could not be considered because it was not in the original application. There is no rule of patent law that subject matter added in the course of the prosecution of a patent application, adding no objectionable new matter to the original disclosure and making explicit that which was implicit, may not be considered in the construction of the patent,

especially when the subject matter (here the illustrative run) is added at the request of the Patent Office in lieu of the same subject matter appearing in the stricken original claim (here keeping continuously before the Patent Office Dubbs' original teaching of vapor generation in the B tubes).

(e) Finally, the District Court held that the "generally accepted" meaning of the word "vaporization" is "generation of vapor". There are at least two meanings generally attributed to the word, and if it be true that some dictionaries refer to generation rather than to liberation, that is not a ground for rejecting the second and alternative meaning when the patentee has chosen it. Such leading dictionaries as The Century, Funk & Wagnalls and the new Oxford Universal Dictionary, and scientific authorities of which some are mentioned in the Appendix to this brief, concur that either meaning is available. The error of the District Court lay in failing to find that Dubbs had clearly ascribed the second meaning [liberation] to the word.

2. The opinion of the Circuit Court of Appeals indicates that the Court had not obtained any clear grasp of the issue involved. Several glaring errors of fact indicate the Court's difficulties, for example:

(i) The Court assumed that even if it accepted petitioner's definition of vaporization as liberation, oil cannot be heated to the cracking point without such vaporization (*i.e.*, without liberation). Every witness in the case concurred in testifying, as the laws of physics obviously compel them to do, that with sufficient

velocity and turbulence, the oil would move through narrow tubes (such as the 4-inch tubes) in a frothing and foamy mass without any liberation or separation of the vapors from the liquid, just as this occurs in respondent's operation.

(ii) The Court said that in respondent's process there was "an encouragement or at least no prevention of vaporization" and "this is so no matter what meaning is given to the word vaporization". The undisputed evidence is that there is no vapor separation (petitioner's meaning) in the B tubes of the accused process.

(iii) The Court stated that, accepting petitioner's definition of vaporization (liberation), defendant's process "heats to a point where cracking and vaporization take place", and "in defendant's apparatus the oil is cracked and vaporized in what might be called its B tubes".

Errors of law by the Court were:

(a) Its assumption that the Dubbs claims were not entitled to a liberal interpretation because "in the nature of an improvement";

(b) Its assumption (contrary to the teachings of *Smith* v. *Snow*, 294 U. S. 1, and earlier cases to the same effect), that the claims of the Dubbs patent should be considered alone, without reference to the drawings, specifications and illustrative run; and

(c) Its assumption that the duty of the Court was essentially to read dictionaries, and to select therefrom what it might conceive to be the weight of authority among lexicographers. The Court carried this error

to a most unfortunate degree as it quoted single brief sentences out of a number of dictionaries, in many of which a more extensive quotation would have shown the alternative meaning.

The Egloff Patent

The accused process involves the series of steps defined by the Egloff claims without either "additions or elimination of steps". Infringement is plain without invoking the doctrine of equivalents. There is literal response to every claim element.

The utility of Egloff is proven by respondent's literal following of it in its own commercial process. The advantage provided to the respondent and other users is that Egloff treats the raw oil preliminary to its entry into the main cracking coil (B tubes), screening and cleaning it, and insuring that the charge to said coil is in all cases a distillate stock from which all heavy-coke forming ends have been eliminated.

ARGUMENT

PART A: THE DUBBS PATENT

Point I

The accused Winkler-Koch Process infringes the Dubbs patent.

Respondent does not contend that the Winkler-Koch process was designed from inventions, the subject-matter of applications for patent or of patents owned by respondent or other members of the "Patent Club". Nor can respondent seriously contend that the accused process stemmed from the prior art.

As has been stated (p. 40, *supra*), it was designed by self-styled "post graduates of Universal". It is therefore not surprising that the accused process closely follows the Dubbs patent and the commercial structures designed by petitioner thereunder. Indeed respondent does not dispute the fact that the accused process embodies clean circulation with all of its advantages.

The District Court (40 F. Supp. 581) stated the issue of infringement in terms perhaps over-simplified, but helpfully clarifying, thus:

> "Defendant [respondent] says that the word vaporization means generation of vapor and that plaintiff's patent limits his process to one in which no vapor is generated in the initial tube or chamber where the heat is applied. Plaintiff says vaporization means liberation of vapors and that his patent provides for generation of vapor in the heating chamber and liberation in the second chamber. If plaintiff's interpretation is correct, defendant infringes. If, on

the other hand, the term is to be given the meaning for which defendant contends, defendant does not infringe."

Respondent's argument, as the opinions of the courts below show, is fostered in a grammatical vacuum having no relation to the practical aspects of the problem and giving no heed to the history of the Dubbs patent or to the patent as a whole.

A. The Patent Document as a whole demonstrates that the phrase "without substantial vaporization" means that liberation or separation of vapors from the liquid oil is precluded, but that generation of vapors in the B tubes of the Dubbs process is not precluded.

The basic principles applicable to the construction of patents are fully settled. The patent must of course be construed as a whole, and according to the ordinary rules governing the construction of written documents. *Goodyear Dental Vulcanite Co.* v. *Davis,* 102 U. S. 222; *Strong-Scott Mfg. Co.* v. *Weller,* 8 Cir., 112 F. 2d 389.

A corollary of this basic proposition is that the intention of the patentee will be given substantial weight in the construction of the patent. *Cimiotti Unhairing Co.* v. *Am. Fur. Ref. Co.,* 198 U. S. 399, 410; *Paper Bag Patent Case,* 210 U. S. 405, 419; *Smith* v. *Snow,* 294 U. S. 1. Thus a patentee may choose his own words and adopt such definitions as he may deem proper in stating his invention. *Cimiotti Unhairing Co.* v. *Am. Fur. Ref. Co., supra.*

In ascertaining the meaning to be given to the words of the claim, the court is not confined to the limits of the claim in question but should examine the claim in the light of the

specifications. "The claims of a patent are always to be read in the light of its specifications", *Schriber-Schroth Co.* v. *Cleveland Trust Company*, 311 U. S. 211, 217; *Hogg* v. *Emerson*, 47 U. S. 436, 478; *Smith* v. *Snow*, 294 U. S. 1, 14; *Exhibit Supply Company* v. *Ace Corp.*, 315 U. S. 126, 134-135.

Moreover, if upon an examination of the claims and specifications of the patent as granted, there still exists an ambiguity in the mind of the court with respect to the meaning of the claims, it may examine the descriptions in the claims as originally filed to resolve the ambiguity. Thus, this Court stated in *Hubbell* v. *United States*, 179 U. S. 77, 80:

> "It is quite true that, where the differences between the claim as made and as allowed consist of mere changes of expression, having substantially the same meaning, such changes, made to meet the views of the examiners, ought not to be permitted to defeat a meritorious claimant. While not allowed to revive a rejected claim, by a broad construction of the claim allowed, yet the patentee is entitled to a fair construction of the terms of his claim actually granted."

Accord: *Exhibit Supply Co.* v. *Ace Corp.*, 315 U. S. 126, 134; *cf. Marconi Wireless* v. *United States*, 320 U. S. 1, 28, 29.

In construing the meaning of a patent "The Court should proceed in a liberal spirit, so as to sustain the patent and the construction claimed by the patentee himself, if this can be done consistently with the language which he has employed," *Klein* v. *Russell*, 86 U. S. 433, 466; *Smith* v. *Snow*, 294 U. S. 1, 14; and "if the claim were fairly

susceptible of two constructions, that should be adopted which will secure to the patentee his actual invention rather than to adopt a construction fatal to the grant," *Smith* v. *Snow, id.*

So here we turn to the entire patent as granted. Indeed, in the instant case, the District Court recognized that this is the criterion for determining the meaning of a patent-claim, but failed to follow the rule.

"Reading the claim with the specifications and drawings, which are both clear", *Temco Co.* v. *Apco Co.*, 275 U. S. 319, 330, and interpreting the claim "in the light . . . of the particular form in which the petitioner reduced the claim to practice as described in the specifications," *Smith* v. *Snow*, 294 U. S. 1, 14, it seems clear beyond any possible dispute that the phrase "without substantial vaporization" (or equivalent phrases) as used in the patent means that vapor *liberation* in the B tubes is precluded, but that vapor *generation in the B tubes is not precluded.*

I. THE WORD "VAPORIZATION" AS USED IN THE DUBBS PATENT CANNOT MEAN "GENERATION".

(a) *Cracking, with vapor generation, takes place in "cracking tubes" B.*

The Dubbs patent states explicitly that the tubes B are *cracking* tubes. In the statement of objects of the invention, the patent says (VII, 3089, lines 13-19):

> "Among the salient objects of the invention are to provide for a process in which the oil is continuously fed through the *cracking zone* and thence through

> the vapor zone, and a portion of the generated vapors condensed and returned to the inlet side of the *cracking zone* * * *."

The portion of the generated vapors which is condensed and returned to the inlet side of the cracking zone (the reflux condensate) is returned to the entrance of the tubes B. Hence the cracking zone referred to in the foregoing quotation necessarily includes the tubes B. The description of the apparatus and of the operation of the process begins with the statement that "B are the cracking tubes" (VII, 3089, line 52). Claim 7 refers to these tubes as "tubes seated in a cracking zone" and as "cracking tubes" (VII, 3091, lines 46, 57). This makes it clear that unless the specious argument that Dubbs misnamed these tubes is accepted, at least a substantial part of the cracking occurs in cracking tubes B.

Respondent's expert Smith conceded that at the operating pressure given in the patent "you couldn't get very much cracking in the B tubes without substantial vaporization" (III, 1151).

Dr. Brown testified [II, 654-5] that the oil is heated and cracked in these tubes and that as the oil passes through these tubes there is a generation of vapor therein, but there is no separation of vapors from the liquid oil.

In contrast, Dubbs never refers to the tubes B as "vaporizing tubes" or as "being located in a vaporizing zone."

The patent also states (VII, 3089, lines 74-8) that the material to be treated discharges through line J'

> "* * * into and through tubes B and during the time they are passing through said tubes, they are subjected to sufficient heat *to cause the desired amount of cracking.* * *"

This statement clearly indicates that there is a regulated amount of cracking in the tubes B (II, 661).

(b) *A part of the vapor is generated in tubes C; the balance in tubes B.*

But, since cracking involves a time factor, the cracking process started in the B tubes continues in the vaporizing tubes C. The specification of the patent recognizes this when it says:

"The per cent of vapors *generated* from the oil as it passes through the tubes C will depend on the amount of heat acquired by said oil while passing through the 4" coils" (VII, 3089, page 1 of patent, lines 108-12). If but a "per cent" of the vapors *generated* is generated in the C tubes, where is the balance (100 minus that "per cent") generated? Obviously in the B tubes (II, 662). So here again from this language the conclusion is inescapable that the phrase "without substantial vaporization" (or equivalent) in the B tubes cannot exclude generation in these tubes.

(c) *A large amount of vapor is necessarily generated in the B tubes in the operation of the illustrative run.*

We turn next to the illustrative run described in the specification (VII, 3090, page 2 of patent, lines 35-65). To the oil technologist* the conditions as to heat and pressure specified for that run spell *inevitable generation* of vapor in the B tubes (II, 726; III, 1148-51, 1153). In-

*It is settled rule that patents are addressed to those skilled in the art to which they relate. *Eibel Co.* v. *Paper Co.*, 261 U. S. 45, 65-6; *Carnegie Steel Co.* v. *Cambria Iron Co.*, 185 U. S. 403, 437; *A. B. Dick Co.* v. *Barnett*, 2 Cir., 288 Fed. 799, 801.

deed, petitioner's expert, Dr. Brown, testified that throughout the entire temperature range specified in the illustrative run, there would be very material vapor generation in the B tubes. He said (II, 656):

> "Under the conditions of 750 degrees F. and 100 pounds pressure, this gas oil as described would contain at least 20 or 25 per cent by weight of generated vapors of the oil as it passes through the cracking tubes B. At the higher temperature, 860 degrees F. under the same pressure conditions this oil would contain upwards of 90 percent by weight of vapors generated within the oil as it leaves the cracking tubes B."

In his direct testimony, respondent's expert, Howard V. Smith, voices the opinion that "vaporization" as used in the patent means vapor generation,* but that opinion cannot be accepted in the light of his subsequent admissions, for he was unable to reconcile it with the patent disclosure.

With respect to the illustrative run Smith conceded that, except at the very bottom of the temperature range specified in the illustrative run, a "very substantial amount" of the oil would be converted to vapor in the B tubes, even without cracking; that the amount of vapor would be augmented if cracking occurred;** and that the presence of the

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*In the *Root* case defendant contended that vaporization was the symbol for "cracking" (6 F. Supp. 767). Therein the Courts rejected that contention and found that *as used in the Dubbs patent* "vaporization" necessarily connotes the liberation, or separation, of the vapors from the oil stream.

**It is indeed significant that operating in the upper range of temperatures given in the illustrative run, vapor generation will necessarily occur in the B tubes, according to respondent's expert, whether or not cracking takes place in those tubes—crack-

cycled reflux would still further increase the amount of vapor generated (III, 1153, 1148-50). These concessions forced him to the admission (III, 1150):

> "Q. Consequently, considering such a run as that and considering your interpretation of the word 'vaporization', *the two don't fit at all,* do they?
>
> "A. *No, they don't fit.*"

The unsupportable premise of his direct testimony having been destroyed, Smith suggested on cross-examination that the stipulated "100 pounds pressure" of the illustrative run be increased to make the teachings of the patent fit the Smith theory as to the meaning of its claims (III, 1148, 1151).

Again he admitted (III, 1150) that the very bottom of the temperature range specified in the illustrative run

> "* * * was the only part which *by any possibility* would support my interpretation of the word 'vaporization' and make the claim to the patent read upon the typical run of the patent at approximately 100 pounds pressure."*

But even in that "only part which by any possibility" would support Smith's interpretation of the patent, he found it necessary to depart radically from the principle of the

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ing would only increase the amount of vapor generated in the B tubes over that generated without cracking (III, 1149-50). Thus, if the illustrative run is given its proper significance, respondent's argument that the name "cracking tubes" given by Dubbs to the B tubes is a misnomer, and does not mean that cracking, with the resultant vapor formation, occurs in the tubes, becomes immaterial.

*The "100 pounds pressure" referred to in the testimony just quoted is that specified for the illustrative run (VII, 3090, page 2 of patent, line 56).

patent in order to reconcile it with his theory. In his attempt to show that the specifications disclose a practice consistent with his interpretation, he postulated that it would be necessary "to operate with some mild heating of the C tubes to *maintain* the temperature therein in order to operate there successfully" (III, 1088). The "mild" heating proposed by Smith would have to be sufficient, under his assumption, to *impart additional heat* to the oil in the C tubes. This is so because heat is absorbed by vapor generation and cracking (III, 1067-8), and it would be necessary for Smith to add enough heat to the oil to compensate for this in order to "maintain the temperature." This condition is contrary to the teachings of the patent, for Dubbs states that his process may be operated without any heat for the C tubes,—insulation merely being required (VII, 3089, page 1 of patent, lines 99-105), thereby indicating that no additional heat is to be supplied.

Dubbs states as an alternative that a light fire may be used under the C tubes, not, however, to furnish additional heating to the oil to "maintain its temperature", but merely to prevent the loss of heating from radiation, a very different proposition.* (II, 754, 752-3; III, 1088; 1067-8).

Indeed, Smith's reconstruction of the Dubbs specification would endow the Dubbs process with the defects of the

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*In an operation according to the teachings of the patent, the temperature of the oil in the C tubes falls below its temperature when discharged from the B tubes. (This is due to the losses of heat due to *vapor generation* and *cracking* which are not compensated for by insulation, or its equivalent, the mild heating of the C tubes). That this is so appears from the record in evidence (Pl. Ex. 597) of one of the demonstration runs, which shows that the temperature of the oil in the vaporizing tubes was approximately 100 degrees lower than that of the oil in the cracking tubes.

Burton process in which the oil temperature was maintained by a fire under the shell in which vapor liberation occurred, to overcome loss of heat by cracking and vapor generation as well as by radiation.

(d) *The meaning respondent ascribes to the word "vaporization" violates the patent disclosure and the rule governing claim construction.*

Respondent and its expert, in reaching the view which it pressed upon the Court that the word "vaporization" in the Dubbs patent means vapor generation, completely reversed the procedure usually followed for ascertaining the true meaning of a disputed claim-word, or phrase, and departed from the criteria which this Court has approved for that purpose.

It dogmatically adopted one meaning of the word, viz., vapor *generation*, and contended that that was the sole meaning of the word, fortifying its contention on the point by reference to a number of dictionaries and some textbooks. Petitioner has unreservedly admitted that *vapor generation* is *one* meaning of the word "vaporization".

Respondent having confined, or circumscribed, the disputed word by this rigid, or dogmatic, definition, then imposed the claim so construed upon the disclosure found in the descriptive part of the patent specification and all parts of the latter were so read as to keep them so circumscribed, notwithstanding that does violence to the express language of the patent and its application as filed, when interpreted in the light of immutable laws of physics.

Smith began by assuming a meaning of the claims favorable to his cause and then rewrote the specifications to fit that meaning. Such procedure is directly contrary to the

rule of law which requires that the claims be construed in accordance with the specifications. No such adroit manipulation can be sufficient to save respondent from the charge of infringement.

That respondent interpreted the patent by following the procedure just stated is clear from a brief extract from the testimony of its expert Smith as follows (III, 1148):

> "Q. Well, as I understood you, you said there was no substantial amount of vapor generation in the B tubes, isn't that your representation as to the Dubbs patent?
>
> "A. That is what the *claims* call for, yes, sir.
>
> "Q. Well, that is your representation as to the Dubbs patent, is it not? Isn't that what you told the Court?
>
> "A. Well, when you take in the *claims*, yes, that is true."

Nevertheless, Smith was forced to concede that the patent does disclose a process wherein there is vapor generation, but no liberation, in the B tubes (III, 1147):

> "I didn't mean to give the impression that a primary contention that I made is that due to the term 'without substantial vaporization' as I found it in the patent, that the Dubbs process is confined to one where there is no substantial vaporization [*generation* of vapors, per Smith's use of the word] in the B tubes. . . ."

The expert finally said (III, 1151):

> "It is not my view, considering the Dubbs patent *as a whole*, that you don't get vapor generation in substantial amount in the B tubes and you don't get cracking in substantial amount in the B tubes."

(e) *Respondent's contention that "vaporization" means "vapor generation" is rejected by Claims 5 and 6.*

Claim 5 of the patent calls for "affording a vaporization space above the stream" of oil in the C tubes and "taking off the vapors from said vapor space" (VII, 3091, page 3 of patent, lines 11-5). The space above the liquid level in the C tubes obviously *cannot* be a space for *generation* of vapors, but only for their liberation (H, 661). It must be obvious to the Court that generation of vapor from a liquid body *cannot occur above the liquid.* Immediately preceding the words "affording a vaporization space above the stream," the claim, in defining the conditions in the B tubes, specifies that the oil is subjected "to a cracking temperature while preventing substantial vaporization" (*id.*, lines 9-11). The word "vaporization" used in successive lines undoubtedly means the same thing. Consequently, claim 5 does not make sense if respondent's construction is to be followed. It makes sense only when petitioner's view is adopted.

The force of this argument is emphasized by the language of claim 6, in which provision is made for "a vapor space . . . above the level of the oil wherein vaporization takes place" (VII, 3091, p. 3 of patent, lines 33-35). The existence of a space above the level of the oil "wherein vaporization takes place" is consistent only with the meaning of the word "vaporization" claimed by ~~respondent.~~ petitioner In such a space liberation or separation of vapors only could occur.

The difficulty which Smith encountered in attempting to give substance to the meaning which he attributed to the Dubbs teachings is well illustrated in his comment on claim 5 of the patent, the language of which, as we have shown,

cannot be reconciled with respondent's interpretation. As to this, Smith said ". . . we do find words used in a rather odd way in a number of places in the patent" (III, 1102).

II. THE WORD "VAPORIZATION" AS USED IN THE DUBBS PATENT WHEN CONSIDERED AS A WHOLE MUST MEAN "LIBERATION".

(a) *In the patent "liberation" is used as a synonym for "vaporization".*

(1) A fundamental step of the process which Dubbs teaches is the liberation of vapors, or the separation thereof, from the liquid residue. This occurs in the vaporizing tubes C. Dubbs says: "C are the vaporizing tubes" (VII, 3089, line 52). This function of the C tubes is described in two parts of the specification which explain precisely what Dubbs means when he applies the adjective, "vaporizing", to the C tubes. First he states, "said oil is then passed into the tubes C which are only partially filled with oil and as the oil passes through these tubes, *there is a liberation of vapors from same* and which vapors pass up through the vapor tubes D" (VII, 3089, page 1 of patent, lines 78-83). Dubbs thus specifies that the "liberation of vapors" is a function of the C tubes.

The process is next discussed in giving a description of the illustrative run. There Dubbs states (VII, 3090, page 2 of the patent, lines 40-3), "The heated oil then passes to the 10 inch coils C which are maintained about half full of oil and *wherein vaporization takes place.* * * * The vapors pass up through the lines D."

These two phrases are obviously close paraphrases of each other, describing the same objects in like functions and surroundings.

Dubbs has therefore made the word "vaporization" a synonym, in the patent, for the phrase "liberation of vapors". In the general description of his process, Dubbs says that in his C tubes "there is a liberation of vapors" (VII, 3089, page 1 of patent, lines 81-2); in the illustrative run he states that in his C tubes "vaporization takes place" (VII, 3090, page 2 of patent, line 43). That "vaporization" is "liberation of vapors", appears as clearly as if Dubbs had used an equation sign between the phrases. Clearer definition cannot be required.

(2) Wherever and whenever Dubbs in his patent claims refers to the process taking place in his C tubes, *i.e.*, "liberation of vapors", he follows the language he used in describing the function of the C tubes in the illustrative run and uses the word "vaporization". In claim 1 Dubbs states that after the oil has been passed through the cracking zone it is "passed thence to and through a zone where vaporization takes place" (VII, 3090, page 2 of patent, lines 72-3). In this, as in every other claim of the patent, the word "vaporization" is used to refer to that part of the Dubbs process initially described by him as "a liberation of vapors" (VII, 3089, page 1 of patent, line 81).

(b) *Claims 5 and 6 are meaningless unless "vaporization" means "liberation".*

In claims 5 and 6 the word "vaporization" can have no meaning other than "vapor liberation".

As stated *supra*, these claims are meaningless if the word "vaporization" appearing in these claims is given the meaning of vapor generation. A vaporization space above the stream (claim 5, line 9) cannot be intended to designate a space where vapor generation occurs. It

is evidently intended to describe the space above the stream which permits the liberation of the generated vapors from said stream: *ergo* the word in claims 5 and 6 must mean vapor liberation.

(c) *What is inhibited in the B tubes is permitted in the C tubes; since vapor generation occurs in each, "vaporization" means "vapor liberation".*

With the meaning of the word "vaporization" so definitely fixed, it is impossible to imagine that when Dubbs used this same word as part of the same claim-sentence to define the conditions in his B tubes he intended it to have an entirely different meaning.

For example, when in claim 7 Dubbs states that "the oil is heated to the cracking temperature but substantial vaporization prevented, and thence to an enlarged chamber where vaporization takes place", and uses like language in the other claims, Dubbs emphasizes that the process taking place in his C tubes does not take place in his B tubes.

Generation of vapor takes place both in tubes B and tubes C. Hence the process referred to by the word "vaporization" cannot be generation. On the other hand "liberation of vapor" is referred to only as occurring in the C tubes. Thus the phenomenon which occurs in the C tubes but which is avoided in the B tubes, and which cannot be generation, must be liberation. Therefore, the word "vaporization" in the Dubbs patent must refer to vapor liberation.

The only reasonable construction of the language used is that Dubbs, in each of the patent claims, was seeking to draw a distinction between phenomena in the B tubes and the C tubes of his process. The reason for this em-

phasis is plain. If any substantial amount of liberation of vapor occurred in the B tubes, a residuary liquid would be left, and due to the heat applied the rapid formation of carbon deposits would result (II, 656-7). The prevention of such a condition was one of the essential steps contributing to the success of the Dubbs clean circulation invention. Accordingly, no vaporization, *i.e.*, liberation of vapors, could take place until the oil reaches the part of the process where provision could be made to separate the unvaporized oil from the vapor in a zone where the oil receives no heat and where the separated residue can be drawn off. Such provisions, as the drawings, specifications and claims of the Dubbs patent all show, are made only in the vaporizing or C tubes, where only radiation losses are offset by insulation or mild firing and from which the residue can be withdrawn through the pipe K (VII, 3089, line 94).

These being the facts, the language of the patent cannot mean to the oil technologist anything other than that the thing forbidden in the B tubes and required in the C tubes is vapor *liberation*. This must be so because (a) he knows the patent says alternatively that "vaporization takes place" in the C tubes and that there is a "liberation of vapors" in the C tubes; (b) he knows the patent says the B tubes are *cracking tubes* and that vapors are formed in the cracking tubes B, but that the heating of the oil in the B tubes is "without substantial vaporization"; and (c) the only meaning for the word "vaporization", consistent with these phrases, with the balance of the specification, including the illustrative run, and with the practical usages of the oil industry, is vapor liberation.

(d) *Residue is that which remains after the vapors have separated themselves from the liquid oil.*

Emphasis is lent to the foregoing conclusion by the words of claims 1, 2 and 6 calling for "removing the residue, after said vaporization." A residue is something left behind, so this language again indicates that vaporization is used in the sense of separation or liberation and not mere generation, *i.e.*, formation of a foam.

The action described in the phrase just quoted is common in a distillatory process (III, 1145-6). The meaning of "vaporization" in the Dubbs patent cannot be made doubtful by Mr. Smith's statement (III, 1101) that this phrase does not mean removing the residue *after* vapors are both formed *and separated* from the liquid oil in the C tubes or by his sophistical contention (III, 1192) that, because the non-volatilized oil *per se* is the same before and after the vapors separate therefrom, it is proper to call it residue prior to the separation.

To remove the non-volatilized oil prior to the liberation of the vapor would be foolish, because as to the Dubbs operation neither the reflux condensate nor the desired pressure distillate would be obtained and the process would not work. But the removal of the non-volatilized oil left behind as a residue after the vapors have liberated themselves is a useful action. It is that which is exhibited in the process of the Dubbs patent and which respondent's expert finally conceded occurs alike in the process of the patent and in the respondent's operation (III, 1160-1).

These were the views of Dr. Brown (III, 1366).

The oil technologist also knows that, as admitted by Smith (III, 1163), vapor generation, unaccompanied by the passing off of the vapors from the non-volatilized oil, has no useful application in the petroleum refining industry.

(e) *The expert testimony establishes that "vaporization" as used in the patent connotes "vapor separation".*

The testimony of the experts shows that the only proper construction is the one urged by petitioner.

Dr. Brown testified on cross-examination as to the meaning of "vaporization" in the patent (II, 707-8):

> "Q. Well, what do you think he [Dubbs] meant by the term?
>
> "A. I think he means by the term 'vaporization' the complete separation of the vapors from the liquid, and his process that he defines as 'vaporization' hasn't taken place until there is a liquid residue left and the vapors have passed off as vapors . . .
>
> * * * *
>
> "It is perfectly clear that by 'vaporization' he means the separation. That is what he means, that you must have the separation of the vapors from the liquid in order to accomplish vaporization .
>
> "Q. It is not clear whether he means both generation and separation?
>
> "A. He does not mean generation by 'vaporization'. That is specifically excluded. To have vaporization he must in all cases have the separation step. Now, I believe that that is what it is limited to. My interpretation is that the word 'vaporization' is limited to that separation step."

Dr. Brown also considered the possible dual meaning of the word "vaporization" and concluded, "But in my opinion the word 'vaporization' is used *in the Dubbs patent* to mean the separation or the liberation of vapors" (II, 738).

Respondent's evidence does not meet the testimony just quoted. The testimony of respondent's expert Smith has been discussed *supra*, pages 73-77; it establishes that, in

Smith's own views, the patent as a whole discloses a process wherein substantial vapor generation takes place in the B tubes (III, 1151). And respondent's witness, Dr. Cady, a general scientist without practical experience in the oil industry (II, 805), merely stated that in his opinion "The word 'vaporization' *standing alone*, has a definite meaning which is the change of a liquid or solid into a vapor" (II, 791).* Whatever may be the merit of this definition of the word in a complete scientific and grammatical vacuum, it is apparent that Dr. Cady was not asked, and was not qualified to give, any interpretation of the word "vaporization" *as used in the patent*, and not "standing alone" but in its context. The same considerations apply to the testimony of Dr. Reiman (III, 1288-9).

B. The original disclosure reinforces petitioner's interpretation of the phrase "without substantial vaporization".

All that has been said above about the conclusions to be drawn from the specification, save only that part based on the illustrative run, is applicable to the specification as originally filed, and reference to the original claims lends strong additional support to petitioner's contention. Original claim 1 (IV, 1515-6) called for:

> "1. A process of converting heavy into lighter hydrocarbons, consisting in passing the oil *through a heating coil in a cracking zone*, passing the oil and *generated vapors* into a vapor chamber, taking off the vapors from said vapor chamber . . ."

*Even on this score respectable authority shows that Dr. Cady unduly limited the meaning of the word (See Appendix at the end of this brief).

Like language appeared in claim 2. These claims, of course, constituted a part of the original disclosure.

The Court of Customs and Patent Appeals in *Foss* v. *Oglesby et al.*, 127 F. 2d 312, 315 said:

> "It is, of course, elementary that original claims in an application as filed constitute a part of the disclosure of such application."

If the original claim language had remained, or if it had been transferred *ipsissimis verbis* to the specification, there could have been no doubt. What was actually done leaves the matter just as free from doubt in so far as oil technologists, to whom the patent is addressed, are concerned. As previously stated, the illustrative run was inserted at the request of the Patent Office.* It was not until the time of its insertion (IV, 1520) that original claims 1 and 2 were cancelled (IV, 1521). We have shown that this illustrative run, just as the original claims did, tells the man skilled in the art that vapors are *generated* in the B tubes; and, consequently, the statement in the claims of the patent that heating in the B tubes is "without substantial vaporization" certainly cannot mean that no vapor is generated therein. So whether we consider the specification and claims as filed or the specification and claims as finally issued, the result is the same.

In *Marconi Wireless Co.* v. *United States*, 320 U. S. 1, 28, this Court had occasion to consider the Stone patent as a reference against the Marconi patent in suit and com-

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* "* * * no applicant can justly be blamed for acquiescing in a command by lawful authority, much less can he properly be made to suffer loss by obedience"; *American Laundry Machinery Co.* v. *Prosperity Co.*, 2 Cir., 295 Fed. 819, 821.

mented that "Stone's patent, * * * makes explicit, as the patent law permits, what was implicit in Stone's application". In the case at bar there can be no question but that Dubbs' original application was explicit enough, but the *Marconi* case settles the proposition that it is of no moment that the particular verbiage was altered, since the essential teaching remained unchanged. "The law has outgrown its primitive stage of formalism when the precise word was the sovereign talisman, and every slip was fatal."*

C. The demonstration runs of the Dubbs process made just prior to and contemporaneously with the filing of his patent application and the subsequent commercial operations licensed thereunder reject respondent's meaning applied to the word "vaporization" in the Dubbs patent.

(1). *The Independence Demonstration Unit.*

The facts regarding these runs have been set forth in some detail (p. 26, *supra*). Before the filing of the application for the Dubbs patent, and while this application was being prosecuted, Dubbs had in operation, under his direct supervision, a unit at Independence, Kansas, where convincing demonstrations of his process were made to the industry (I, 506-7).

In all the operations of this demonstration unit substantial vapor generation occurred in the cracking tubes B without vapor separation, and the vaporization or vapor separation occurred in the enlarged vaporizing tube C.

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*CARDOZO, *J.*, in *Wood* v. *Duff-Gordon*, 222 N. Y. 88, 91; see 305 U. S. xvi.

Pyzel, a practical and experienced petroleun scientist representing the Royal Dutch-Shell Company, observed an operation of the demonstration unit late in 1918 or early in 1919, just prior to the filing of the Dubbs application (I, 506-08). Testifying in respect to his observations he said (I, 508):

> "There were vapors formed in the four inch tubes but the separation of the vapors from liquid which would constitute a vaporization took place in the ten inch tubes."

and at (I, 507) he said:

> "In the ten inch tubes vaporization of the product coming from the four inch tubes took place that is to say the vapors were separated from the heavy residual liquid."

At the temperatures and pressures prevailing in the cracking tubes B of this unit, Dubbs or any other technologist, having but elementary knowledge of physical laws, would have known that very substantial vapor generation occurred in the oil stream traveling therethrough.

Again in the mid-summer of 1919 the same Independence unit was demonstrated to representatives of the National Petroleum Association and of the Western Refiners Association (I, 377). The operating conditions of this run have been clearly established by the original records covering the entire run that continued uninterruptedly over a period of nine days (PX 597, II, 830-31). The unit and the process carried out therein during this demonstration run did not in any substantial respects deviate from the operation Pyzel witnessed late in 1918 or early in 1919.

The undisputed testimony of Dr. Brown, based upon the operating conditions prevailing during this demonstration

run, is that substantial vapor generation did take place in the cracking tubes, and that the oil therein was in the form of a foam consisting of liquid oil containing bubbles of generated vapor. (II, 687-8). No liberation or separation of such generated vapors from the liquid oil occurred in the B tubes due to the velocity of the oil passing therethrough, but such vaporization or liberation did occur in the vaporizing tubes C (II, 688).

These demonstration runs, made under the supervision of Dubbs just prior to and contemporaneously with the filing of his patent application, are relevant, material and convincing in determining the essentials of the process to which the Dubbs patent is addressed and the proper construction to be given the word "vaporization" as it appears therein.

This Court, in *Marconi Wireless Telegraph Company* v. *United States* and *United States* v. *Marconi Wireless Telegraph Company*, 320 U. S. 34, in the construction of a prior art patent, stated:

> "We would ordinarily be slow to recognize amendments made after the filing of Marconi's application and disclosing features shown in that application. *Cf. Schriber-Schroth Co.* v. *Cleveland Rust Co.*, 305 U. S. 47, 57, [39 USPQ 242, 246]; *Powers-Kennedy Corporation* v. *Concrete Co.*, 282 U. S. 175, 185-6 [7 USPQ 122, 126] *Mackay Radio Co.* v. *Radio Corporation*, 306 U. S. 86 [40 USPQ 199]. But here Stone's letters to Baker, whose authenticity has not been questioned in this case, afford convincing proof that Stone had conceived of the idea of tuning all four circuits prior to the date of Marconi's invention. *Cf. Bickell* v. *Smith-Hamburg-Scott Welding Co.*, 53 F. 2d 356, 358 [10 USPQ 222, 224]."

(2). *Commercial Operations Licensed Under the Dubbs Patent.*

The operation of the demonstration unit was promptly followed by the development of a so-called "standard 500 bbl. unit" for the practice of the Dubbs clean circulation process. A total of 256 of such units were installed and operated commercially between 1922 and 1929 by licensees under the Dubbs Patent. These units were erected in 49 different refineries (p. 37, *supra*).

Based upon the conditions prevailing in the operation of these units, the undisputed testimony of Dr. Brown is that very substantial vapor generation without vapor separation occurred in the cracking tubes B and that the oil and generated vapors as a foamy mass discharged into the vaporizing zone where vapor separation or liberation occurred (II, 693-94). Thus the evidence is that in each and every operation of the Dubbs process, from its inception by Dubbs, and by his many licensees, *vapor generation inevitably and necessarily occurred in the B tubes without liberation.* It is illogical and unreasonable to assume that practically the entire industry with abundant technical and legal talent at its command would have accepted licenses under the Dubbs patent and paid substantial royalties to practice a process that was open to the public and could have been used by all with impunity.

D. The presumption is that Dubbs understood the operation of his process and did not exclude it from the purview of his patent claims.

Dubbs was an experienced refiner at the time of the operation of his demonstration process at Independence. He had spent practically his entire life in the oil refining

art. From 1913 until he terminated his connection with petitioner in 1930 he was continuously engaged in research and development work relating to the production of gasoline (I, 392-407). The demonstration unit as we have seen was erected under his supervision. Its operations were likewise all carried out under his direction and supervision for informing the oil refining industry of the characteristics of his process.

Respondent's contention as to the meaning of the word "vaporization" in the Dubbs patent requires the illogical and unreasonable assumption that Dubbs, in making known his great contribution to the oil industry, which the District Judge found revolutionized the art, did so in utter disregard of the actual operation of his process and the conditions prevailing therein. Respondent's contention requires the further extraordinary assumption that Dubbs failed to recognize in his process that which the skilled in the art could not fail to, and did, observe.

It likewise does violence to reason to assume, as respondent contends, that Dubbs, fully informed as he was as to all conditions prevailing in the operation of the demonstration process and all of its essential characteristics, would have so limited his patent claims, directed to this revolutionary invention, as to exclude the same from the scope thereof.

This Court in *Diamond Rubber Co.* v. *Consolidated Rubber Tire Co.*, 220 U. S. 428, 436-7, said:

> "It is difficult to suppose that the contriver of a successful device did not understand how it operated * * * and committed it to the world * * * without understanding or attempting to discover the law and principle of its organization and efficiency. * * *

We find this the contention difficult to handle. When a person produces a useful instrument to say that he did not know what he was about is at least confusing. * * * His success is his title to consideration."

E. The file wrapper history of the Dubbs patent application fully supports petitioner's construction of the questioned phrase.

The original application was criticized (IV, 1518-9) because of the absence of detailed figures as to operating conditions, and the claims were rejected on March 14, 1919 on this ground and on certain items of prior art. In response to this rejection, in the first amendment, dated September 5, 1919, the illustrative run that has been fully discussed was added, and the claims were rewritten (IV, 1520 *et seq.*). The rewritten claims refer to the C tubes as "a chamber where vaporization takes place" (IV, 1521).

But the amended claims, like those originally filed, fell short of defining clean circulation; unlike the specification, they did not affirmatively state that the residue was removed from the system and not cycled.

The next action of the Patent Office dated March 4, 1920 (IV, 1526) indicated that the specification was now wholly acceptable to the Patent Office except for an error of spelling. The claims were rejected as failing to define invention over a patent to Smith and a Trumble British patent corresponding to the United States Trumble patent.

By the second amendment of July 6, 1920 (IV, 1527) the error in spelling was corrected and the claims were again rewritten. These claims adhered to the language of the specification and of the first amendment by characterizing

the C tube zone as one where "vaporization takes place" (IV, 1527-31). The claims recited that the reaction zone was kept "free from residual products of the vapor chamber" (IV, 1527-8). The remarks accompanying the amendment (IV, 1533) emphasized the carbon accumulation infirmity of the prior art (including Trumble) and that Dubbs had cured this infirmity by cycling reflux condensate *uncontaminated with the residue* from the vapor separating step, or, briefly stated, by the non-cycling of the residue.

The next action of the Patent Office dated July 28, 1920 (IV, 1534) rejected the claims for indefiniteness in that they defined the B tubes as a "heated zone of reaction." The Examiner said "Since this is a cracking process it is essential that the heated zone of reaction should be raised to a cracking temperature and this expression ['heated zone of reaction'] should be amended to indicate that such temperature is used." In this action the Trumble patent was mentioned but not used as a reference. The claims were rejected on a combination of an Edwards patent and a Smith patent, the Examiner erroneously thinking that Smith disclosed "a complete removal of carbon from the oil returned to the zone of reaction."*

By the third amendment dated April 13, 1921 (IV, 1536) the claims were rewritten to the form identical with claims 1 to 8 of the patent. In the accompanying remarks (IV, 1540) it was said:

> "The processes disclosed in the Edwards and Smith patents are radically different from that disclosed in the present application, it being sufficient to note that in each the material under treatment

*Respondent has not contended in the courts below that the Examiner was right in this.

travels in a cyclical path, so that at least a portion of the separated carbon is returned to the cracking zone."

It was in this rewriting of the claims that the controversial words "without substantial vaporization" (or equivalent words) first appeared. They were not inserted at the behest of the Patent Office. Dubbs did not rely on them to differentiate from the Edwards and Smith patents, because, as just stated, the difference insisted on was that, in Smith and Edwards, carbon was returned to the cracking zone. It will be borne in mind that by the previous amendment (IV, 1527-31) the claims had been revised to say that "vaporization takes place" in the C tubes. But they were not, at that writing, so expressed as to preclude vapor separation in the B tubes.

Dubbs knew that, as stated in his original application, vapors would be generated in the B tubes. Therefore, he inserted the *caveat* that the cracking must be accomplished "without substantial vaporization" (or its equivalent), that is, without the liberation of vapors, in the B tubes.*

On this third amendment the application was allowed (IV, 1541). After allowance it was requested that an additional claim be entered and this request was granted (IV, 1545), the claim being claim 9 of the issued patent.

As stated, the "illustrative run" of the Dubbs process now found in the patent specification was presented in an

*This becomes especially clear when it is recalled that the Dubbs patent application in its original form, as amended, and in its final state was based on the actual operation conducted by Dubbs in his plant at Independence. In this actual operation, vapors were generated in the B tubes, but separated only in the C tubes (I, 507-8; II, 687-8).

amendment filed September 16, 1919, at the same time that claims 1 and 2 were canceled. These original claims expressly called for "passing the oil and *generated* vapors" from the cracking tubes into the vaporizing tubes. The illustrative run also expressly says *to the skilled in the art,* by giving (a) character of oil, (b) oil temperature range, (c) pressure, that vapors are *generated* in the stream travelling through the cracking tubes and pass therefrom, mixed with the non-volatilized oil, to the vaporizing tubes. The phrase containing the questioned word was presented by amendment filed April 13, 1921.* Thus the "illustrative run" was in the application *when the amendment aforesaid was filed* and is material and relevant in the construction of the disputed phrase. It precludes a construction of the phrase prohibiting vapor generation in the B tubes. Had the amendment been at variance with the specification, the Patent Office Examiner would have rejected the claim as departing from the patent specification, or as attempting to interpolate "new matter". That he did not do so is very persuasive evidence that he did not construe the word "vaporization", as used, to be synonymous with *vapor generation.*

Considering the patent as a whole, or considering the application at the date of the amendment of April 13, 1921, when the controversial words first appeared in the claims, the same conclusion must be reached regarding the meaning of the word "vaporization", *viz.* that, as used in the claims, it does not mean vapor generation.

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*At least eight years prior to the advent of the accused process and prior to the intervention of any adverse right of the public *Schriber-Schroth Co.* v. *Cleveland Trust Co.,* 305 U. S. 47.

The court below seemed to think that the words "without substantial vaporization" (or equivalent) were what Dubbs relied on to differentiate his invention from the prior art; 137 F. 2d 7. This, as has been shown, is not the fact. The original claims did not adequately define clean circulation, specifically in that they did not affirmatively recite that the residue, remaining after vaporization took place in the C tubes, was not permitted to return to the heating zone.

Thus it appears that the sole step of the process upon which defendant in the *Root* case and respondent in the instant case sought to escape infringment was not used to distinguish Dubbs from any prior art item relied upon as anticipatory by the Patent Office.

Petitioner does not contend that, because the disputed phrase was not novel with Dubbs and was not so treated either by the applicant for the patent or the Patent Office Examiner, it may be ignored in applying the patent claim to the accused process. Full effect must be given to the phrase. But it is manifest that it was not put in the claim to distinguish from the cited prior art. Dubbs distinguished from it by limiting the claims to the *non-return of the residue to the cracking coil, i.e.,* the cycling through the cracking coil of reflux condensate *uncontaminated* by the residue.

When this feature, repeatedly urged as that of the invention, was shown to the Examiner to be new, he deemed that Dubbs' application disclosed invention, and that the invention was adequately defined by the claims.

F. There is no file wrapper estoppel.

A file wrapper estoppel could only arise if the file wrapper showed that the words "without substantial vapor-

ization" (or equivalent words) had been inserted to exclude from the claims any process wherein vapor *generation* occurred in the cracking coil. The file wrapper manifests no such intention, and, in view of the disclosures upon which the claims are based, the words themselves impart no such limited meaning.

The rule of estoppel by claim cancellation goes no further than to inhibit a patentee from dropping out of his patent claim a limitation which will leave it practically coextensive with a canceled claim, in order to bring an accused structure within the purview of the patent. (*Smith* v. *Snow*, 294 U. S. 1; *Godwin* v. *International Steel Tie Co.*, 6 Cir., 2 F. 2d 198.) Petitioner has never sought to have dropped from the claims the limitation "but substantial vaporization prevented" (or equivalent).*

The question of file wrapper estoppel cannot even be involved here, for the respondent's process infringes upon the patent as finally issued, irrespective of its file wrapper history. *Ceramic Process Co.* v. *General Porcelain E. & Manuf'g Co.*, 7 Cir., 129 F. 2d 803, 806; see *C. Howard Hunt Pen Co.* v. *Radiant Point Pen Corp.*, 2 Cir., 135 F. 2d 870, 873. It exhibits each and every step recited in the claims in suit even without resorting to the doctrine of equivalents. In the *Ceramic Process* case, the court pointed out that where a process infringes upon a claim as finally issued, the decision of this Court in *Exhibit Supply Co* v. *Ace Corp.*, 315 U. S. 126, is of no assistance to the infringer.

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*Petitioner is not asserting for the present claims the same scope as original claims 1 and 2. These *are not*, in terms, as the present claims *are, limited to the non-return of any substantial part of the residue to the cracking tubes*, a step essential to "clean circulation".

The situation here is like that considered by this Court in *Smith* v. *Snow*, 294 U. S. 1, where the Court said, pp. 15-6:

> "It is an illuminating fact that the entire written argument filed in support of Claim 1, as it was finally presented to the Patent Office and allowed, makes no reference to any order or arrangement of the eggs, or to shifting the location of the eggs in the incubator, no reference to the location of the fan, the direction of the air current, or to curtains or partitions. The features emphasized were the superiority, over drafts caused by variations of temperature, of 'current produced by mechanical means' applied to eggs in staged incubation arranged at different levels, the conservation of moisture, and the elimination of foul air by the restricted air outlets, all features of Claim 1 which are characteristic of both petitioner's and respondents' incubators. We find nothing in the file wrapper to suggest that any addition was made to Claim 1 to restrict the patent to any particular order of arrangement of the eggs or any particular direction or means of control of the current of air, other than its velocity, and nothing to estop the patentee from asserting that the claim is not restricted by such features. [Citations] It is of no moment that in the course of the proceedings in the Patent Office the rejection of narrow claims was followed by the allowance of the broader Claim 1."

The situation is wholly unlike that in *Schriber-Schroth Co.* v. *Cleveland Trust Co.*, 311 U. S. 211. In the Jardine patent there involved, the sole feature of novelty, without which the claims could not stand, was the flexible web. The file wrapper showed that Jardine, by the cancellation of

claims, had *disclaimed* this sole vitalizing feature. In the present case no act of disclaimer appears. True, the words "generated vapors" did not reappear after the cancellation of original claims 1 and 2, but in the same amendment the illustrative run was inserted in the specification and this run, together with the other language of the specification already discussed, shows that the disclosure of vapor generation without liberation in the B tubes was constantly in the application. *Cf. Crown Cork Co.* v. *Gutmann Co.*, 304 U. S. 159.

G. The meaning which petitioner asserts for the phrase "without substantial vaporization" is one sanctioned by common usage and by the dictionary and is the only one which imparts to the claims of the Dubbs patent any practical meaning or utility.

The word "vaporization" is not a term of art. It is a fairly ordinary English word having different connotations in different contexts. It has *two* accepted meanings, one being that asserted by respondent, the other being that asserted by petitioner. The District Court found that the "generally accepted" meaning is *generation* but did not suggest that the alternative meaning—*liberation*—is not supported by ample dictionary and textbook authority. Neither court below so found.

At the very commencement of the trial in the instant case petitioner admitted that the word "vaporization" is frequently and properly used as a symbol for vapor *generation*. But it urged that it is also frequently and properly used as a symbol for the passing off, in a practically gaseous state, of molecules from a liquid, or for the phenomenon

of which the passing off or *liberation* of vapors is a *sine qua non;* and that the word is used in this sense in the Dubbs patent.

Such was the understanding expressed by Judge Lindley in his opinion in the instant case, as we understand it.

It was so held by the Circuit Court of Appeals in the *Root* case and by the District Court in that case.

Dr. Brown expressed the same view in the instant case (II, 707-8, 738), and respondent's expert Smith admitted that the word "vaporization" is often applied to the phenomenon characterized by the interdependent steps of vapor generation and vapor liberation (III, 1071, 1163).*

Meaning of the word "vaporization" in the industry.

As to the use of the word "vaporization" in the industry to connote the passing-off of vapors from the body of oil in which they had been generated, Dr. Brown testified that in the commercial Gyro cracking process, in connection with the action occurring in the vaporizing tubes, where the vapor is separated from the liquid and conducted to the cracking tubes (II, 702), the term "vaporization" is used as meaning the passing off or liberation of the vapors (II, 703).

The word vaporization has also been accorded the meaning contended for by petitioner in the patented art. In the United States Patent to Behimer No. 1883850 (Volume VII, 3494-3504) granted to The Texas Company on an original application filed November 21, 1918, relating to a cracking process, claim 30 in part reads:

*The Court will have in mind that Smith in his testimony studiously used the word "vaporization" as a synonym for vapor generation.

> "*separating the lighter constituents by vaporization from the residual oil*, passing the evolved vapors through a separator * * *."

Here unmistakably the word vaporization is used as a synonym for vapor liberation and connotes separation of the vapors from the residual oil.

No distillation process would have any utility unless the vapor generation were accompanied by vapor separation or liberation. Smith said (III, 1163):

> "In the petroleum refining industry I don't think offhand of any useful application of a distilling operation where you have vapor generation unaccompanied by the passing off of the vapors from the non-volatilized oil."

Dictionary and textbook meanings.

It was by no means true that dictionaries or encyclopedias unanimously support the construction given by the Circuit Court of Appeals.

The true weight of authority among lexicographers gives both meanings. For example, The Century dictionary, after defining "vaporization" as "the act or process of vaporizing" (in the sentence quoted by the Court below) proceeds to define "vaporize" as follows:

> "1. To convert into vapor by the application of heat, reduction of pressure or other means; cause to evaporate.
>
> "2. *To pass off in vapor.*"

And Funk & Wagnalls' Standard Dictionary, also quoted by the Court below to the effect that "vaporization" means

"the act or process of vaporizing", defines "vaporize" as follows:

> "1. To convert into vapor or gas as by application of heat; evaporate.
>
> "2. To turn into vapor or gas; *pass off in vapor.*"

To the same effect are the new Oxford Universal Dictionary and the Imperial Dictionary of the English language.

Throughout the quotations by the learned Circuit Judge, there runs the thought that vaporization is "the act of vaporizing". But this goes no further than to require definition of the verb. In scientific works, as well as in the better dictionaries, both meanings are recognized for the verb.

The lexicographers should play but a small, if any, part in this case. *Smith* v. *Snow*, 294 U. S. 1, points the proper road to decision.

However, we have incorporated in an Appendix, at the end of this brief, a collection of definitions which accord to the word "vaporization," as a word of general usage, the meaning that petitioner ascribes to it in the context of the Dubbs patent. In the same Appendix there is included an excerpt from the testimony of Dr. Brown on the subject (II, 708, 779-82). His testimony shows, as do the appended definitions, that the meaning for which petitioner contends is a very usual one.

There are, to be sure, decisions, *e.g. Dennis* v. *Pitner*, 7 Cir., 106 F. 2d 142, cited by the courts below (137 F. 2d 6), which hold that a patentee may be his own lexicographer. We submit that Dubbs did not undertake to be his own lexicographer in the sense that he used the word "vaporization"

to connote something not ordinarily understood thereby. But if it should be concluded that he did not use the word in an accepted sense, petitioner's contention should still prevail, because there can be no doubt as to the meaning intended by the claim language when read in the light of the patent as a whole. Such meaning will be followed by the courts.

The applicable principle of law is that wherever possible a patent will be construed to secure the invention to the patentee rather than in a manner fatal to the grant. *Smith* v. *Snow*, 294 U. S. 1, 14; *Apex Electric Mfg. Co.* v. *Maytag*, 7 Cir., 122 F. 2d 182, 187; *Strong-Scott Mfg. Co.* v. *Weller*, 8 Cir., 112 F. 2d 389, 394; *Samson-United Corp.* v. *Sears, Roebuck & Co.*, 2 Cir., 103 F. 2d 312, 315. To construe the claims of the Dubbs patent as inhibiting the generation of vapors in the B tubes is to adopt a construction entirely fatal to the grant because it puts the claims at variance with the specification and, moreover, limits them to a process which, so far as appears, has never been used and has no practical significance. On the other hand, to construe the patent as merely prohibiting the liberation of vapors in the B tubes is to adopt a construction which vitalizes the grant, makes the claims consistent with the specification and makes them cover the process which the refining art, save for the contention of the Winkler-Koch Patent Club, has always understood them to cover.

H. If the matter were doubtful, petitioner's construction should be upheld in view of the revolutionary advance which the invention has made in the cracking art.

This Court said in *Smith* v. *Snow*, 294 U. S. 1, 14:

> "If the matter were doubtful, it is plain from what has been said that the character of the patent

> and its commercial and practical success are such as to entitle the inventor to broad claims and to a liberal construction of those which he has made. *Moreley Machine Co.* v. *Lancaster*, 129 U. S. 263, 273-277; *Eibel Co.* v. *Paper Co.*, 261 U. S. 45, 63; *Winans* v. *Denmead, supra*, 341. In such circumstances, if the claim were fairly susceptible of two constructions, that should be adopted which will secure to the patentee his actual invention, rather than to adopt a construction fatal to the grant, *Keystone Manufacturing Co.* v. *Adams*, 151 U. S. 139, 144, 145; *McClain* v. *Ortmayer*, 141 U. S. 419, 425."

This language is singularly appropriate to the present case. The application for the patent in suit was based upon the process as demonstrated in the Independence plant. The invention, as there practiced, was the same as that disclosed in the patent. The invention has had more than ordinary commercial success; its record is one almost unparalleled in patent cases. The old processes of making gasoline were abandoned in favor of the Dubbs process.

In view of the evidence disclosing an industry-wide search for the clean circulation process which Dubbs ultimately found, the language of Mr. Justice SHIRAS, speaking for this Court in the *Keystone Manufacturing Co.* case, 151 U. S. 139, 144-5, is apposite:

> "But when, in a class of machines so widely used as those in question, it is made to appear that at last, after repeated and futile attempts, a machine has been contrived which accomplishes the result desired; and when the Patent Office has granted a patent to the successful inventor, the courts should not be ready to adopt a narrow or astute construction, fatal to the grant."

To construe the Dubbs patent as respondent does, would leave it addressed to a process which has never been practiced in the industry and would mean that the many oil companies which unhesitatingly took licenses under the Dubbs patent paid millions of dollars for licenses covering a paper process which they never used. To say the least, it is most unlikely that, if respondent's contention were well founded, either to the layman or to the oil technologist, these licenses would ever have been taken out.

I. The Dubbs patent teaches to the man skilled in the art the maintenance of a foam in the B tubes.

The Dubbs patent does fully describe all the features needed to obtain the velocity or turbulence necessary to maintain the liquid and generated vapor in the form of a foam in the cracking tubes B, to avoid segregation of the vapor from the liquid in the cracking coil. It illustrates and describes a high pressure charging pump giving the requisite pressure to force the fresh oil through the cracking tubes B at the desired velocity. It also discloses and describes an elevated partial condenser or dephlegmator (as was used in the demonstration unit) providing a hydrostatic feed with an elevated head adequate to pass the heated reflux condensate through the cracking tubes at a velocity sufficient to prevent segregation of the vapors from the non-volatilized oil (II, 751). The Dubbs patent further teaches that the cracking tubes B shall be of relatively small or restricted diameter favoring high velocities and turbulence in contrast with the enlarged vaporizing tubes C where the vapor liberation from the non-volatilized oil occurs. From such disclosures the man skilled in the art, knowing that in the Dubbs patent crack-

ing is to occur in the B tubes without liberation or separation of the generated vapors from the liquid oil therein, would inevitably pass the oil through the B tubes at the speed or velocity necessary to provide a foamy mixture in these tubes. By so doing, vapor separation in the B tubes is prohibited, as taught by the Dubbs patent, and efficient heat transfer to the oil stream is attained. Such conditions will inevitably and necessarily obtain in the operation of the Dubbs apparatus, as disclosed in the patent, if the teaching of the specification is followed. They were obtained in Dubbs' demonstration runs.

Dr. Brown's unequivocal testimony (II, 725) on this matter was:

> "You operate the Dubbs apparatus as disclosed in the patent and follow his teachings and you inevitably get that condition. You can't help yourself."

Testifying on the same subject (II, 751-52) Dr. Brown said:

> "A. Well, I would put it perhaps a little differently than that, that the Dubbs patent clearly teaches a velocity which is sufficient to prevent separation.
>
> "Q. As I understand it you get this teaching of this velocity from the statements in the Dubbs patent, that the oil should be heated in the B tubes without substantial vaporization, is that correct?
>
> "A. Not necessarily, no. He provides a sufficient head in the drainage system to force the oil through the B tubes—the B tubes are short and there is only a small number of them—with a sufficient velocity to maintain the turbulent state in the B tubes. And it was well known at that time that for efficient heating of the oil the oil should move

through these small tubes with as much velocity as possible.

* * * * * * * *

"Q. That you needed a high speed?

"A. For efficient heating we wished to put the oil through the tubes at as high a speed as we could obtain.

"Q. That was well known by everybody, was it?

"A. Yes, for heating oil particularly at that time.

"Q. And that it would be rather silly to put the oil through the tubes at a low rate of speed?

"A. Well, otherwise, I see no point in using the B tubes and C tubes. It would simply be a case of just putting a bunch of big tubes in there and pushing the oil through them.

"Q. I am asking you whether the art knew it?

"A. They did at that time. That was well appreciated."

From the disclosure of the Dubbs patent including the illustrated apparatus and the operating conditions described in the specification, Dr. Brown computed (II, 760-61) the velocity of the oil which would prevail through the B tubes; and he testified that, with such velocity, there could be no possibility of a separation of the vapor from the non-volatilized liquid and that the mixture would enter the vaporizing tubes C as a foam.

Smith did controvert this point, on the basis of his experience. But his opinion was based on two irrelevant observations of what may have occurred (1) in a large "look box" or "separating box" in an atmospheric pressure distillation apparatus (III, 1138) and (2) in the large horizontal drum of a Jenkins still (III, 1139-40), quite similar to the hori-

zontal drum of the Burton-Clark separating shell. Neither of these operations is at all comparable to what occurs in the small diameter B tubes of Dubbs maintained under a high pressure or afford any sound basis for the conclusion that separation of the vapors from the liquid oil would occur in the B tubes in following the teachings of the Dubbs patent (III, 1367-9).

Indeed in defendant's main brief in the *Root* case it was unequivocably said that under the conditions prevailing in the B tubes of the Dubbs patent, no liberation or separation of the generated vapors could possibly occur therein.

As pointed out by the Circuit Court of Appeals in the *Root* case, 78 F. 2d 998, defendant, at page 21 of its main brief, said:

> "The physical conditions of the onrushing stream of oil in these tubes (the B tubes of the Dubbs patent) would be such as to preclude the possibility of a condition where a tranquil liquid level could exist from which vapors might be separated and liberated from the liquid. * * * On the other hand in the ten inch tubes of the patent the velocity of the stream is greatly decreased. These C tubes are only partially filled, thereby providing a liquid level from which vapors generated in the cracking operation are released and escape through the vapor lines D of the patent and through the vapor line from the top of the reaction chamber in the commercial operation."

The same Court also pointed out that on page 91 of defendant's main brief it is said:

> "In view of the rapid velocity of the oil in the B tubes, liberation of vapors therein could certainly

not exist at all either substantially or unsubstantially."

Counsel appearing for respondent here also appeared for the defendant in the *Root* case. In the case at bar they completely shift the position they contended for in the *Root* case. Here the inconsistent and irreconcilable argument is advanced that the Dubbs patent fails to teach to the man skilled in the art a velocity in the B tubes sufficient to prevent vapor separation therein.

Moreover, as stated by Dr. Brown (II, 752), all the skilled in the art prior to the advent of the Dubbs invention well knew that to obtain a high heat transfer efficiency in a cracking coil or a pipe still it was necessary to pass the oil through such a coil at a sufficient speed or velocity to produce turbulent flow. It was equally well known to all skilled in the art prior to Dubbs that with such turbulent flow the oil and generated vapors would be in the form of a foamy mass, with the liquid oil in the external phase of the mass, and the vapors occluded in the liquid.

Such prior knowledge is *inter alia* clearly and fully set forth in the United States patent to Trumble 1,281,884 granted October 15, 1918 (VII, 3294) having an effective date of July 19, 1915; or the corresponding British patent 15084 of 1915 (VII, 3557). In the United States patent it is said (VII, 3295, ll. 75 to 99):

> "The heating means comprises a series of pipes suitably connected to form a single continuous heating coil. The oil enters the coil at a moderate velocity and as it passes through the coil large quantities of vapors are gradually produced therein. The vapor remains *intimately mixed with the body of the oil* due to its rapid motion *forming a foam* which

gradually increases in volume and consequently travels with an increasing velocity through the heating coil.

"The high velocity of the oil in the closed ring produces several important results among which the following may be mentioned:

"(a) This high velocity results in a high efficiency of heat transference enabling large quantities of heat to be transferred to the oil from a relatively small heating surface.

"(b) This high velocity results in a very uniform heating of the *foamy mixture* of oil and vapors. * * *"

The same "foamy mixture" discharging from the heating coil as described in the Trumble patent will inevitably be formed within and be discharged from the comparable pipe heater or cracking tubes B of the Dubbs patent. Anyone skilled in the art would obtain this condition in the cracking tubes B of Dubbs to prevent vapor separation from the liquid oil and to insure efficient transfer of heat to the oil stream.

In *Carnegie Steel Co.* v. *Cambria Iron Co.*, 185 U. S. 403, 437, this Court said:

"He may assume that what was already known in the art of manufacturing steel was known to them and as observed by Mr. Justice Bradley in *Loom Company* v. *Higgins*, 105 U. S. 580, 586, 26 L. Ed. 1177, 1179 'he may begin at the point where his invention begins and describe what he had made that is new and what it replaces of the old. That which is common and well known is as if it were written out in the patent and delineated in the drawings.'"

J. The construction of the patent by the District Court and Circuit Court of Appeals in the Third Circuit was correct.

The same technical defense, based on the phrase "without substantial vaporization", was presented by the Patent Club in the *Root* case, and was specifically rejected both by the District Court and the Circuit Court of Appeals.

The District Court opinion.

The opinion of the District Court dealing with this defense is instructive (6 F. Supp. 767):

> "The whole defense of noninfringement hangs upon the construction and interpretation of the words 'without substantial vaporization' in the cracking tubes. Defendant states this 'is a matter of vital and, so far as infringement goes, controlling importance.' Defendant holds that 'vaporization' in the claims of the patent is synonymous with cracking.* It stakes its whole defense of non-infringement upon this position. It contends the Dubbs patent excludes substantial cracking in the cracking tubes, whereas defendant's process involves substantial cracking in the cracking tubes.

*From this statement in Judge Nield's opinion and in the light of what has been said above, it will be seen that the Patent Club in the trial of the *Root* case recognized that there could be no cracking in the B tubes of the Dubbs' patent without a concomitant *generation* of vapor therein. Consequently, the Patent Club found it necessary, in support of its argument of non-infringement, to contend that the "cracking tubes B" of the patent were *not* "cracking" tubes and that no cracking occurred therein. Presumably it was because they failed in these contentions in the *Root* case that they shifted positions in the case at bar and asserted through Smith that it was possible to operate under some other conditions laid down in the Dubbs' patent without vapor generation in the B tubes.

"'Vaporization,' in the phrase 'without substantial vaporization' in claim 1 of the Dubbs patent and in the equivalent phrases of the other claims, does not mean cracking. This conclusion follows from a consideration of the patent and of the pertinent evidence. In the specification of his patent, Dubbs says: 'B are the cracking tubes. C are the vaporizing tubes.' From these terms one would naturally conclude that Dubbs designed a process with substantial cracking in the cracking tubes. The primary function of the C tubes is to separate the vapor from the liquid. One would also naturally conclude that Dubbs had this separation primarily in mind when he called C tubes 'vaporizing tubes.' A patent, like any grant, should be interpreted as a whole and, as near as may be, a consistent whole. On page 1 of the specification, lines 75 to 83, inclusive, Dubbs states that the reflux and fresh charge are discharged 'through tubes B and during the time they are passing through said tubes, they are subjected to sufficient heat to cause the desired amount of cracking. Said oil is then passed into the tubes C which are only partially filled with the oil and as the oil passes through these tubes, there is a liberation of vapors from same and which vapors pass up,' etc. Moreover in the illustrative run given in the specification of the patent on page 2, lines 38 to 43, inclusive, Dubbs states: 'Thence to the 4 inch coils B which are subjected to a temperature of 750° to 860° F. The heated oil then passes to the 10 inch coils which are maintained about half full of oil and wherein vaporization takes place.' This range of heat in the cracking tubes is cracking temperature and at the stated pressure would inevitably result in cracking. Again, in claim 5, the second step of the Dubbs process is defined as 'affording a vaporization space above the

> stream during the second stage of the travel thereof.' Vaporization here cannot mean cracking as a cracking space above the stream would be meaningless. 'A 'vaporization space' means a space for liberation of vapor. The words in the claim immediately preceding the words quoted are 'while preventing substantial vaporization.' 'Vaporization' used in successive lines undoubtedly connotes the same meaning."

No comment on this opinion is necessary in view of its obvious logic.

The opinion of the Third Circuit Court of Appeals

The Third Circuit Court of Appeals discussed the same matter in detail in its opinion (78 F. 2d 996-9). After reviewing the contentions and expert testimony, that court said (at p. 998):

> "It is evident that when the patentee said that the oil was heated to a cracking temperature in the B tubes, but 'without substantial vaporization,' he meant without substantial liberation of the vapor, for he says on page 2, lines 40-43, when the mixture enters the half-filled C tubes 'vaporization' takes place. This word as here used means 'liberation' of the generated vapor from the liquid, for after 'vaporization' takes place in the C tubes, he says that the vapors pass up through the lines D to the pipe E, etc. On page 1, lines 78-84, in describing the process, he says: 'Said oil is then passed into the tubes C which are only partially filled with the oil and as the oil passes through these tubes, there is a liberation of vapors from same and which vapors pass up through the vapor tubes D, E and into the header G.' He thus defines 'vaporization'

by the words, 'liberation of vapors.' It is in this sense that 'vaporization' is used in the claims."

These opinions are persuasive. They give to the patent, covering a "new and revolutionary invention," a meaning consistent not only with the language used, but with reason and common sense. They construe the patent in such a manner that it covers the useful process which has; in fact, been installed under its teachings in hundreds of refinery operations carried on by many oil companies, both large and small.

Point II

The decisions of the courts below are erroneous in holding the Dubbs patent not infringed.

The construction of the patent adopted by the courts below, on the contrary, deprives the patent of all meaning and is based upon reasoning which fails to take into account the teachings of the patent as a whole, and the actual operations of Dubbs at the time when he applied for the patent.

1. The District Court Decision is Erroneous.

In view of the fact that the Court of Appeals adopted the opinion of the District Court on the issues of infringement and the meaning of the word "vaporization" (137 F. 2d 6), we must look primarily at the District Court's conclusions.

The opinion of the District Court (40 F. Supp. 575) is based upon four fundamental errors:

a. The finding that no cracking takes place in the B or cracking tubes of the Dubbs process, and that therefore no generation of vapors takes place therein. The error here lies not only in the premise, but also in the conclusion.

b. The expressed view "that Dubbs had no clear idea of what happened in the B tubes, and that he did not consider it important."

c. The exclusion from consideration of the illustrative run contained in the patent on the ground that it was added by amendment; and the exclusion from consideration of the matter taken out of the patent at the time of the amendment on the ground that it had been superseded.

d. The application of an unduly restricted definition of the word "vaporization" as used in the patent.

a. *The Cracking Zone Error.*

The District Court initially emphasized the distinction made by Dubbs between the "cracking zone" and the "vapor zone" of his process (40 F. Supp. 582), but then said that the patent did not state that "the desired amount of cracking occurs in the B tubes and from the whole patent it is clear that what he is attempting is to impart to the oil in the B tubes the heat that will cause it to crack in the C tubes" (*ibid.*). From this the court concluded that the generation of vapor must take place in the C tubes, and consequently the phrase "without substantial vaporization" means that there is no substantial generation of vapors in the B tubes.

The Court's major premise and its conclusion ignore the patent as a whole.

The specification of the patent describes a process "in which the oil is continuously fed through the cracking zone and thence through the vapor zone and a portion of the generated vapors condensed and returned to the inlet of the cracking zone" (VII, 3089, page 1 of patent, lines 13-9). The Court's conclusion ignores this teaching. It also ignores the specific definition in the patent, referring to the illustrated apparatus, that "B are the cracking tubes" (*id.*, lines 52-3). Had Dubbs intended merely to heat in the B tubes and crack in the C tubes, he would scarcely have labeled the B tubes as the "cracking tubes" and referred to them as the "cracking zone". Dubbs carried this logic through his claims for he refers to the B tubes there (claim 7) as "a series of tubes *seated in a cracking zone*" (VII, 3091, page 3 of patent, lines 46-7), as "cracking tubes", (*id.*, lines 57-8), or as "cracking zone" (*id.*, lines 60-1). Undoubtedly, therefore, the patent teaches that cracking takes place in the tubes B. As petitioner's testimony conclusively shows (II, 655), "These tubes are called the cracking tubes and the heating tubes. The oil is heated and cracked in the tubes".

Since cracking involves a time factor, the cracking process continues in the C tubes; accordingly, as the patent indicates, a "per cent. of vapors" is generated in the C tubes under the conditions specified (VII, 3089, page 1 of patent, line 108). But this does not, as the District Court held, lead to the conclusion that *cracking*, the natural function of the "cracking tubes B", as described by the Dubbs process, was not carried out therein. On the contrary, it shows that vapors must be generated in the B tubes for only a "per cent." of the total vapors is generated in the C tubes.

But even if there were any support for the District Court's conclusion that when Dubbs said "heating tubes seated in a cracking zone," and "cracking tubes" he did not mean that cracking would there take place, none the less the heating of oil to cracking temperatures in the B tubes would in and of itself cause the generation of vapors in these tubes whether or not there was cracking therein. The conditions specified in the illustrative run, as we have demonstrated above, make the generation of vapors in the B tubes an inevitable consequence of the heat applied under the pressure specified even without cracking.

b. *The Erroneous Presumption that Dubbs did not know the Operation of his Process.*

The court's conclusion that Dubbs "had no clear idea of what happened in the B tubes" is not supported by the record, but is *contrary* to it, for Dubbs set down his knowledge, apparent from the successful operation of his Independence plant, in his original application when he stated, *inter alia*, that the oil "*and generated vapors*" passed from the cracking zone or B tubes to the vapor chamber or C tubes (IV, 1515-6) and reiterated it to the man skilled in the art when he inserted the illustrative run, wherein vapor generation inevitably occurred in the B tubes.

The court, in reaching a contrary conclusion, without any evidence in support thereof, acted as erroneously as did the lower courts in *Diamond Rubber Co.* v. *Consol. Tire Co.*, 220 U. S. 428, 436-7, *supra*.

c. *The error relating to the Patent Application and its Amendments.*

The District Court seemed to agree with the petitioner's contention that, if the illustrative run were to be considered

in construing the patent claims, a process wherein vapors were generated, but not liberated, in the B tubes would be encompassed by the claims; but the court disposed of this contention by saying, "It must be noted, however, that this description of the illustrative run was not in the original application but was inserted in the first amendment to the original application" (40 F. Supp. 583).

The court then turned to a discussion of the original application specifically containing in its claims the statement that "oil and generated vapors" pass into a vapor chamber from the cracking tubes (40 F. Supp. 583). This statement, indicating clearly that Dubbs contemplated the generation of vapors in the B tubes, was held ineffective on the ground that this phraseology had been changed and the specific reference to generated vapors had been later cancelled.

We have fully gone into the history of the patent application amendments above, and have indicated that Dubbs' disclosure was in no way changed by the amendments. We reiterate here only the undisputed fact that, *when the claims containing the phrase "and generated vapors" were cancelled in the course of a general amendment, the illustrative run, setting forth in a different way the same subject matter, was by the same amendment added to the application* (IV, 1520-1). This indicated beyond any doubt that Dubbs did not by his amendment change his process in any way or say that the generation of vapors was not to take place in the cracking tubes B.

The District Court thus held, most incongruously, that Dubbs could derive no benefit on the matter at issue from his original claims because he subsequently cancelled them, and could not have the benefit of the added illustrative run

(teaching, as the original claims did, vapor generation in the cracking tubes B) because it was added by amendment. And this despite the fact that by his course of action he kept his teaching of vapor generation in the B tubes continuously before the Patent Office. *Crown Cork Co. v. Gutmann Co.*, 304 U. S. 159.

The failure to consider the illustrative run in resolving the meaning of the word "vaporization" is contrary to the well-established rule that claims of patents must be construed in the light of the patent as a whole. Also contrary to this rule, the District Court failed to consider claims 5 and 6 of the Dubbs patent, which clearly indicate that the word vaporization in the Dubbs patent cannot mean vapor generation but must mean vapor liberation.

d. *The error as to the meaning to be given to the word "vaporization."*

The final misconception of the District Court came from his misapprehension that the "generally accepted" meaning of the word vaporization was the "generation of vapor" and that this must be the meaning of the word in the Dubbs patent, because the other definition of the word, namely "liberation", could not be spelled out from the patent as a whole.

We have demonstrated that Dubbs specifically and insistently, throughout the patent, used the word "vaporization" to mean "liberation of vapors" and not the generation thereof. We have shown that it is impossible to give the word "vaporization" the meaning of generation of vapors throughout the patent. We have demonstrated, as a consequence, that an adoption of the decisions below

would result not only in ascribing to Dubbs complete ignorance of his process but in assuming that all of petitioner's licensees paid substantial royalties under the Dubbs patent to practice a process beyond the purview of the patent.

Certainly, in view of what is shown in the Appendix as to the meaning of the word "vaporization", it is not so clearly stamped with the meaning, generation of vapors, that it must have that meaning in the patent, where the patent, its practical background, common sense and reason dictate another meaning—liberation—also recognized by lexicographers.

2. THE CIRCUIT COURT OF APPEALS DECISION IS ERRONEOUS.

The Circuit Court of Appeals adopted the opinion of the District Court on the subject of infringement and the meaning of the word "vaporization", saying that it was so satisfactory that it would be inappropriate to add thereto (137 F. 2d 6).

However, the Circuit Court added to the District Court's opinion quotations from some dictionaries and reference books dealing with the word "vaporization", without reference, of course, to the meaning of that word as used in the patent, as the word should have been construed under the decisions of this Court. The Circuit Court also made several observations of its own which emphasize the erroneous basis upon which the decision there proceeded.

(a) The court asserted that the Dubbs invention was "in the nature of an improvement" and apparently concluded that it should not be accorded a liberal interpretation.

The decision of the Court of Appeals, particularly paragraph (c), (137 F. 2d 6-7), indicated the view that, since Dubbs did not invent the basic process of cracking, his patent on that account could be accorded only a narrow construction. This was a basic error of law, in view of the decisions of this Court.

The Court is incorrect in the statement (137 F. 2d 5) that many different kinds of apparatus were devised and "many were in use". As the District Court found, but two types were in use—Burton and Burton-Clark. Burton-Clark seemed to be the last word at the advent of the Dubbs process. It held the field from at least as early as 1915 and successfully held it until Dubbs appeared.

The Dubbs invention, as taught by the Dubbs patent, was, as the District Court said, "new and revolutionary". It caused the abandonment of the older processes in favor of the process taught by the Dubbs patent. Accordingly, the patent was directed to a most meritorious invention, substantially advancing the art, and was entitled to the most liberal construction to sustain and vitalize it; *Smith* v. *Snow*, 294 U. S. 1, 14; *Eibel Co.* v. *Paper Co.*, 261 U. S. 45, 63.

(b) The Court apparently overlooked the primary feature expressed in all of the claims in suit—return to the cracking tubes of the uncontaminated reflux with non-cycling of the residue—of the Dubbs "Clean Circulation" process, which was responsible for the industry, by words and by acts, considering it revolutionary, and the Court has been misled into believing that a step which was old in the art (the first step of typical claim 7) was the 'heart of a *vital step of the Dubbs process*".

(c) The Court of Appeals also held, in effect, that the claims of the Dubbs patent must be considered alone, without reference to "his invention"—presumably his invention as covered by the drawings, specifications and illustrative run, all contained in the patent. Indeed, the court specifically stated that the drawings accompanying the patent were not to be considered (137 F. 2d 6).

(d) The statement (137 F. 2d 6) that the "meaning which the inventor gives to his words can not be made to depend upon subsequent events, but should appear when the application *is filed;*" has no application to the facts at bar. The meaning which respondent urges for the word "vaporization" is rejected by claims 1 and 2 of the application for the Dubbs patent, *as filed,* and by the conditions which obtained, immediately prior to and contemporaneously with the filing of the patent application, in the Dubbs demonstration runs, and which also obtained in the practice of the process in over 256 installations, in the cracking of over 190,000,000 barrels of oil, prior to the entrance of the respondent in the field. Moreover, it is opposed to the only logical meaning which can be given to the word by the man skilled in the art, in view of the teachings of the patent, including the illustrative run which was placed in the Dubbs patent at the time when original claims 1 and 2 were canceled, years prior to respondent's advent.

(e) The Court of Appeals also laid great stress on the word "prevented" appearing in claim 7 of the Dubbs' patent and said (137 F. 2d 7) that in respondent's process there was "an encouragement, or at least no prevention of vaporization", and that respondent made "no effort to *prevent** vaporization". It seems evident from the context

*Italics in original.

that the Court of Appeals, in making these statements, did not understand petitioner's contention or the evidence on which it was based. After saying that there was no "prevention" of vaporization in the accused process, the court below added (137 F. 2d 7):

> "And this is so no matter what meaning is given to the word vaporization".

The undisputed evidence is that there is no vapor separation in the cracking coil (B tubes) of the accused process, the oil being in the form of a foamy mass which completely fills the B tubes (II, 683-4; 695-7; III, 1125). This condition exists because of the velocity and pressure conditions maintained in respondent's B tubes, the separation occurring only when the mass reaches the "separator" (C tubes) where the velocity is reduced (II, 728-9). The maintenance of B tube conditions under which separation cannot take place is obviously a "prevention" of vapor separation. Consequently, the Court of Appeals was wrong in saying that there was no prevention of vaporization "no matter what meaning is given to the word 'vaporization' ".

In the B tubes there was prevention of vaporization, *i.e.*, vapor liberation, the meaning ascribed to the word by petitioner.

(f) Further evidence of misunderstanding of the issue on the part of the court below is found in the statement (137 F. 2d 7):

> "Now the evidence is that oil cannot be heated to the cracking point, which is different in different oils, without vaporization and in thus speaking, we accept *plaintiff's* [*petitioner's*] definition of vapori-

> zation. But defendant's apparatus and its process not only heat to cracking point, but heat to a point where cracking and vaporization take place."

Since "plaintiff's [petitioner's] definition of vaporization" is *separation*, the foregoing statement of the Court of Appeals means that oil cannot be heated to the cracking point without vapor separation, a holding which excludes conditions where the heating tubes (B tubes) are completely filled with a foamy mass. Yet Dubbs did heat and crack the oil in this state at his Independence plant in 1919 (II, 687-8), petitioner's licensees have all done it (II, 693-4), and respondent does it in the accused process (III, 1125).

Moreover, respondent's expert Smith correctly said (III, 1152-3) that in the Dubbs process the oil reaches its highest temperature during its passage through the cracking tubes B. Applying the above-quoted statement of the Court of Appeals to this fact, there results the absurd conclusion, unsupported by and contrary to the evidence in the case, that oil cannot be heated to the cracking point in the Dubbs process without vapor separation in the B tubes.

The Court also erred in that part of the quoted statement that there is a difference between the Dubbs process and the accused process in that the latter "not only heat to cracking point but heat to the point where cracking and vaporization takes place". In both processes, during the passing of the oil through the cracking coil the oil is heated to a cracking temperature, and during this period vapor generation occurs but vapor liberation does not occur. In both processes the non-volatilized oil and generated vapors pass out of this cracking coil into an enlarged vessel,

insulated to prevent loss of heat by radiation, and in which the generated vapors liberate themselves from the non-volatilized oil and pass overhead to the initial condenser.

Again if the word vaporization is given petitioner's meaning, vaporization is prevented in defendant's process.

(g) The further statement of the Circuit Court of Appeals (137 F. 2d 7) that "in defendant's apparatus the oil is cracked and vaporized in what might be called its B tubes and this *is so whether we accept plaintiff's or defendant's definition of 'vaporization'*", is directly contrary to the statement of the District Court on the issue of infringement that "If plaintiff's (petitioner's) interpretation is correct, defendant infringes" and to Smith's testimony for respondent in the instant case (III, 1125).

The errors and misunderstandings just discussed go far to explain why the Court of Appeals mistakenly said (137 F. 2d 6) that Dubbs "tried to give a new meaning to the word 'vaporization' in order to cover the defendant's structure after it became apparent that the ordinary meaning of the language of the patent would not cover defendant's structure". The history of the application and the undisputed testimony as to the manner in which the Dubbs process inevitably operates, if the teachings of the specification are followed, is a full answer to the language just quoted.

PART B: THE EGLOFF PATENT

Point I

The accused Winkler-Koch process infringes the Egloff patent.

The Court of Appeals, noting respondent's contentions (a) that Egloff was a paper patent and (b) "in several respects lacks any inventive attributes", brushed these defenses aside, specifically said it was "not adopting" the District Court's opinion holding the patent invalid, and based its conclusion solely on the ground of non-infringement (137 F. 2d 7). On this score the Court of Appeals said that "the Egloff process is at most a narrow patent, limited strictly to the steps described. It is infringed only when such steps are taken as described. Defendant not only proceeds differently by its process but the differences are both additions and elimination of steps" (137 F. 2d 8).

It is petitioner's contention that the accused process exhibits each of the series of steps defined by the Egloff claims without "additions or elimination of steps" and that infringement is plain without invoking the doctrine of equivalents. Petitioner does not seek, because it does not require, any enlargement of the patent in order to show infringement. There is literal response to every claimed element.

Claim 2 has heretofore been quoted (p. 45, *supra*) and specifically applied to respondent's operation (p. 48, *supra*).

As stated in our discussion of the Dubbs patent, the facts as to the accused process are stipulated (I, 473-9). The testimony of Dr. Brown (II, 684-7) shows how the

accused process responds to the Egloff patent, as do the admissions of respondent's expert Smith (III, 1168-9).

A stipulated flow diagram of the accused operation, PX 508 (II, 670; IV, 1705), constitutes Plate V of the Supplement. This flow diagram is provided with a flap, which should be lifted in considering the Egloff patent. The drawing of the Egloff patent is reproduced in Plate IV of the Supplement.

The accused process was found to infringe by both the District Court and the Court of Appeals in the *Root* case (6 F. Supp. 763, 766, 771, affirmed, 78 F. 2d 991, 999).

The Egloff process and its advantages.

The District Court in the case at bar said it was unable to determine what advantage there was in the Egloff process (F. F. 37, VI, 3060, C. L. 12, VI, 3061). The record contains ample proof of advantage. Dr. Brown pointed out that the Egloff invention involved an improvement over the Dubbs process in that the Dubbs process subjected the cycled material or reflux condensate to a cleaning step each time it went around the cracking cycle, and that Egloff not only did this but also subjected his charging material to a cleaning step (II, 666-7, 768). The Dubbs process involves the feeding of raw oil to the cracking coil (B tubes) admixed with reflux. This oil is of different chemical composition from the reflux. The reflux is a condensate free from the heavy "ends", or unvaporized oil, resulting from the first cracking.

In Egloff the raw oil is separately heated and subjected to an initial distillation, accompanied by mild cracking, in coil 5 and chamber 12, before it travels to the high temperature-high pressure cracking coil (this being the coil 6 of

the Egloff patent or the B tubes of Dubbs). Consequently, under the Egloff process, the only oil which ever reaches the main cracking coil, where the temperature conditions are the highest, where cracking is most severe, and the likelihood of carbon formation consequently the greatest, consists of (1) the charge or fresh oil which has been obtained by a separation of lighter fractions from the heavy oil and partial condensation of the resultant vapors—thus the heavy charging stock has been cleaned, or, as Dr. Brown said, it has been "screened" by an initial distillation and mild cracking operation, and the heavy coke forming fractions have been removed therefrom; and (2) the reflux condensate, also a distillate oil produced in the process.

In describing the respondent's process, having all of the essentials of the Egloff patent, Smith paid a glowing tribute to the economy and utility of the Egloff invention (III, 1123, 1128). His testimony covering respondent's operation, and the essential features thereof which are common to the essentials of the Egloff patent, has been referred to (p. 47, *supra*).

The District Court, in concluding that it was unable to determine the benefits or advantages flowing from the Egloff invention, apparently felt impelled to confine his consideration of the process to a specific example, set forth in the patent, where illustrative temperature and pressure conditions are recited at which the process may be operated. But the patent is not confined to the specific example so given, and temperatures and pressures obvious to the man skilled in the art to carry out the stated objects of the invention may, of course, be used (III, 1169).

The District Court, in finding the patent invalid, stated in so doing that he was unable to determine what benefit may come from

> "this reheating of the reflux condensate and subjecting it to the pressure maintained."

Seemingly the District Court felt that at the illustrative temperature given for the main cracking coil, substantial cracking of the reflux condensate could not be obtained. It is to be observed that the specification of the patent, after referring to the relatively low temperature to which the charging oil is heated in passing through the coil 5 and the relatively high temperature to which the oil is heated in passing through the high temperature coil 6, says:

> "It will be thus seen that the reflux condensate is continuously subjected to recracking but at *different* conditions of temperature of [or] pressure or both than that to which the raw oil is subjected."

It is evident that the only place in the Egloff system in which the reflux can be *recracked* under conditions of temperature and pressure *different* from that obtained in respect of the oil passing through the coil 5 *is in the coil 6.* This being the teaching of the patent, the particular temperature conditions best suited for obtaining the desired active recracking of the reflux in the high temperature coil would be within the skill of the calling. Defendant's expert Smith frequently admitted that it would be within the skill of the art to use temperatures higher than the temperatures specified in the illustrative example to obtain the objects stated in the patent and to obtain high yields of gasoline (III, 1169).

By the mere use of appropriate temperatures, all the stated objects of Egloff may be obtained, as well as the results and benefits which flow from his operation. These have been clearly stated by respondent's expert Smith in

his description of the accused process which contains all the essentials of the Egloff patent.

The record does not show use of the Egloff patent by petitioner's licensees. This, however, is of no moment, because, in view of the plain infringement of the patent by the accused process, respondent's practices are themselves ample evidence of utility and value of the invention. *Smokador Mfg. Co.* v. *Tubular Products Co.*, 2 Cir., 31 F. 2d 255, 256.

Point II

The decisions of the courts below are erroneous in holding the Egloff patent not infringed.

The District Court's Findings Re Egloff

As stated, the District Court found the Egloff patent invalid as lacking utility and not commercially used (VI, 3051), and therefore dismissed the bill as to it. The Court of Appeals did not adopt or disapprove of the finding. It rather suggested that the reasons given in support of the finding were not impressive. Therefore, no further reference will be made to the District Court's holding on the point.

The Circuit Court of Appeals' Findings Re Egloff

The Circuit Court of Appeals dismissed the complaint as to this patent, on the ground that it had not been infringed.

The observations that Egloff's drawings and specifications suggest "a product patent" (137 F. 2d 7), and that "no apparatus is described" (137 F. 2d 8), may be passed

without comment, other than to say that a most cursory inspection of the patent shows that an apparatus is described (VII, 3095).

The non-infringement finding is apparently based upon the circumstance that the accused process differs from the specific steps described in the Egloff patent by both the addition and the elimination of steps (not identified). Petitioner asserts that the accused process contains no such "additions or elimination of steps". But even if it did, there is no suggestion in the opinion that, notwithstanding such additions and eliminations, the essentials of the Egloff process are not included in the accused process and do not form the basis thereof.

Egloff was not, as the Court found, dealing with a problem decidedly different from Dubbs. Egloff devised a process which would include in its operation the Dubbs process, but which would economically pre-treat charging stock containing a large proportion of hydrocarbons rich in carbon, to produce therefrom, as a part of a continuous and unitary operation, a fraction particularly favorable for treatment in what might be called the Dubbs cracking zone.

Egloff's advantages and the slavish copying of the process by respondent appear from the testimony of the latter's expert Smith (III, 1123, 1128).

It would have been of great benefit to this Court and to petitioner, had the Appellate Court made full and specific findings on the infringement question, rather than suggesting that a full statement of its reasons for finding non-infringement (in view of the contrary findings of the District and Appellate Courts in the Third Judicial Circuit) "would be of no interest to anyone save the parties," and relegating anyone having such interest to defendant's brief

and the record for enlightenment. This is particularly true in view of the Court's finding that respondent's structure is far out of the reach of the Egloff disclosure, even when "considerable stretch is given to the latter." As is manifest, the Court did not identify a single step in the Egloff claims which is not found in the accused process, cooperating in the same way with other steps for producing the same result.

CONCLUSION

Both of the patents in suit should be held valid and infringed, and the judgment of the court below should be reversed.

Respectfully submitted,

WM. DWIGHT WHITNEY,
Counsel for Petitioner.

WILLIAM F. HALL,
CHARLES M. THOMAS,
FREDERICK W. P. LORENZEN,
Of Counsel.

APPENDIX

General Meaning of the Word "Vaporization"

The definitions of the word "vaporization" to which we are about to call attention support the proposition that the word, as an ordinary word standing by itself, has two accepted meanings. One of these meanings is the liberation of vapors or the separation thereof from the liquid body.

Doctor Brown, on cross-examination, testified as follows relative to the meaning of the word "vaporization" standing by itself or without regard to its context as used in the Dubbs patent (II, 702-03):

> "The term 'vaporization', standing alone by itself, might easily be interpreted to include vapor generation, and vapor generation and vapor liberation. That is, I mean I believe the term 'vaporization' has been used in many cases designate what I am calling 'vapor generation.' It has not always been used only that way scientifically; it has been used both ways. The term vaporization has been used and is used concurrently to mean that you cause material to pass off as a vapor. You see, vaporization takes place in the separator, vaporization takes place in the still. It is used that way very commonly, and it is also used by technical men to indicate the generation of vapors. It is one of the words that has a rather indefinite meaning, and its precise meaning can be determined only in the way it is used. I don't think the word 'vaporization', in scientific books and in literature and in physics, from time immemorial, has always been defined as the generation of vapors. I think it 'has been used for that purpose, and rightly so.' I do not think it has been exclusively defined that way in physics and chemistry. I think I could

find lots of places in physics or chemistry where it has been defined to mean both generation and liberation. I can't think of one now, but when we vaporize anything in a still, that vaporization is the common word used to express the action that takes place in the still; and in that still we have the generation and the separation of the vapors.

"Q. Do you know of any instance where it has been used, except for the specialized definition that you are now giving to the Dubbs patent, where vaporization, the word 'vaporization' has been used to mean anything else but vapor generation in defining vapors formed in the coil?

"A. Well, the thing that comes to my mind first of all is the description of the gyro process where they had vaporizing tubes, and that is exactly what they meant in those vaporizing tubes, that they separated the vapor from the liquid, and conducted a dry vapor from the vaporizing tubes over to the cracking tubes. It just came to my mind now. There are perhaps other cases like that.

"In those vaporizing tubes in the gyro process, they heated the material to get as nearly complete vaporization as possible, and they left behind in those tubes the small percentage which was not vaporized. There was a small percentage that was not vaporized but I don't know how much of a per cent. They used that term 'vaporization' to mean the passing off as a vapor without carrying with it any liquid, and I think that is a very proper use of the word, and it is clearly the only meaning which we can give to the term in the Dubbs patent."

As we have shown by quotations in the body of the brief, there was no doubt that in Doctor Brown's opinion the word "vaporization" as used in the Dubbs patent meant separation of vapors from the liquid (II, 707-08).

In response to questions which had been put to him on cross-examination, Doctor Brown, on redirect examination, called attention to definitions of the word "vaporization" appearing in dictionaries and scientific works (II, 779-82):

> "On cross-examination I was asked to produce dictionaries giving the word 'vaporization,' the meaning I ascribed to it in its setting in the Dubbs patent in suit. I have here a couple of dictionaries or photostatic pages from them. The Century Dictionary and Cyclopedia by The Century Company gives a dictionary definition for the word 'vaporization' which is, 'The act or process of vaporizing.' You go down to the word 'vaporize' to see what is meant and we find two definitions for the word 'vaporize'. The first one is for the transitive verb, 'to convert into vapor by the application of heat, reduction of pressure, or other means; cause to evaporate', and a second definition given for the intransitive verb, 'to pass off in vapor; as, sulphur or mercury vaporizes under certain conditions', which gives the two definitions one of which means the generation of vapor and the other one the separation of the material in the form of a vapor from a liquid or solid.
>
> "Another smaller dictionary, Macmillan's Modern Dictionary, the word 'vaporize', 'vaporized' or 'vaporizing', gives for the transitive verb, 'turn into or cause to pass off as vapor as by the application of heat,' giving the same definition but giving the definition for the transitive verb that the Century Dictionary gave for the intransitive verb.
>
> "Then there are a couple of references from physics books of a similar nature to those which Mr. Thiess showed me the other day, one from Elements

of Physics by Professor Hoadley of Swarthmore College, which gives a chapter or section on vaporization. The paragraph 302 on page 237, under the title 'Vaporization' describes the operation as follows: "As the molecules of water (or ice) in their vibration strike against the surface, many of them force their way through it and pass into the air where they exist as molecules of water vapor. When heat is applied, the temperature is raised, which means that the velocity of the molecules is increased; and the number of molecules that pass into the air increases with their velocity. As long as the temperature is below the boiling point, the process is called evaporation.' Which is an explanation of the action of vaporization in which the molecules pass away from the mother substance or the water and exist as vapor in the separated state or in the air.

"Another explanation of 'vaporization' from the book Physics for Colleges by Sheldon, Kent, Miller and Paton, 1926, VanNostrand Company, under the heading 'Vaporization' in the second paragraph of Chapter XX on page 168, showing a figure representing molecules within the liquid and describing how the molecules escape from the liquid:

" 'Consider Fig. 20.01. Here, molecule A has as many of its kind pulling it up as pulling down, so that it has no tendency to move in any particular direction. It is balanced on all sides. Molecule B, since its sphere of action extends beyond the surface, has fewer pulling it up than down, and C is in the extreme position of having no forces whatever pulling it up out of the liquid as there are no molecules above the surface, or if any, they are too far apart to count, comparatively.

" 'It would seem then that a molecule would have small chance of escaping from the surface against such odds, but occasionally one will do so because

of acquiring a velocity considerably above the average, by a series of lucky impacts in the proper direction. Thus, molecules of liquid vaporize, as we say, and above a liquid vapor will always be found because of this action,' which in the same paragraph describes 'vaporize' as escaping.

"Then from an engineering text which is widely used in industry and in the universities, Principles of Chemical Engineering, by Walker, Lewis and McAdams, First Edition, 1923, published by McGraw-Hill Company, Chapter XII, Page 375, under the title 'Basic Principles of Vaporization Processes', the second paragraph:

"'Industrial terminology distinguishes three cases in which separation is accomplished by utilizing differences in the volatility of substances.' So that the whole section here deals with separation processes and under 'Vaporization' he describes three different separation processes.

"'Evaporation is the removal by vaporization of a portion of the solvent from a solution of a solid or a practically non-volatile liquid, when the vapor formed is valueless.'

"Then the next type of separation by vaporization is classified as distillation. 'Distillation is the removal by vaporization of one liquid from another when the vapor is of sufficient value to warrant recovery by recondensation.'

"On the next page, the first paragraph, 'When one solid is separated from other solids by vaporization and subsequent condensation the process is spoken of as sublimation.'

"The second paragraph, 'Drying is the removal, generally by vaporization, of one liquid from another liquid or from a solid.' Then an explanation is given of the mechanism of vaporization which is very similar to that given in the physics texts. It

starts at the bottom of page 376 and runs over to the top part of page 377:

"'The molecules of a liquid are considered to be in a state of constant unordered motion, some moving with great velocity, while others move relatively slowly. For any temperature, however, there is a certain mean velocity of the molecules, which for temperatures below the boiling point of the liquid, is not sufficient to project them beyond the free surface of the liquid. But there are always some molecules which possess a velocity sufficiently greater than this mean, that, when they approach the free surface of the liquid, they overcome the mutual attraction exerted between them and other molecules in the liquid, and continuing their motion, pass out into the surrounding space, 'which I think clearly indicates that the word 'vaporization' is used to include processes of separation by vaporization. Much the same language was used in some of the references referred to me by Mr. Thiess."

Referring in more detail to some of the authorities mentioned by Doctor Brown, as well as certain other standard works, we obtain the following definitions:

(a) The Century Dictionary and Cyclopedia defines vaporization as "The act or process of vaporizing; the formation of vapor, or the state of being converted into vapor; treatment with vapor."

The verb "vaporize" which is used in the primary definition of the word vaporization in the above quotation is defined as follows:

1. "To convert into vapor by the application of heat, reduction of pressure, or other means; cause to evaporate."

2. *"To pass off in vapor."*

The verb "evaporate" is defined as "To convert or resolve into vapor; *dissipate* in fumes or steam; convert from a solid or liquid state into a gaseous state."

Reading these three interrelated definitions together leaves no doubt that the noun, vaporization, has at least a twofold meaning and may acceptably be used to mean the act of passing off in vapor or the act of dissipating in fumes or steam. That is the same definition given to the word vaporization by the Dubbs patent which makes it the equivalent of "liberation of vapors."

(b) In Funk & Wagnalls' Unabridged Dictionary, the word "vaporization" is defined as "The act or process of vaporizing or the state of being vaporized."

"Vaporize" is defined as follows:

1. "To convert into vapor or gas as by application of heat; evaporated."

2. "To turn into vapor or gas; *pass off in vapor.*"

(c) In Webster's International Dictionary, Unabridged, 2nd Edition, the noun "vaporization" is defined as the "Act or process of vaporizing, or state of being vaporized; artificial formation of vapor;"

The verb "vaporize" is defined as

"1. To convert into vapor, either naturally or artificially, as by the application of heat, by spraying, etc.

2. To reduce to a vaporous state or form; to cause to become ethereal, dissipated, etc."

(d) *Universal Dictionary of the English Language* (Oxford, 1932):

vaporization is "Act, or process of vaporizing, of converting into vapour; process of becoming vapour."

vaporize is 1. "To convert into vapour."

2. "To be converted into vapour. *To pass off* as vapour."

(e) *Imperial Dictionary of the English Language* (London and New York, 1883):

vaporization is "The act or process of vaporizing; the artificial formation of vapour."

vaporize is "To convert into vapour by the application of heat or artificial means; to cause to evaporate; to sublimate.

"To pass off in vapour."

Here, again, the dual meaning of the word is recognized at a reading of the interrelated definitions giving to the noun "vaporization" both the meaning of the act or process of becoming reduced to a vaporous state or form and that of passing off or becoming dissipated. The latter meaning coincides with that of the word "vaporization", *i.e.*, liberation of vapors, as used in the Dubbs patent.

(f) The definition of "vaporize" found in Hawkins' Mechanical Dictionary by N. Hawkins, published by Theodore Audel & Company, New York and London, 1909, is in point because, as we have seen, each of the standard dictionaries defines the noun "vaporization" in terms of the verb "vaporize." The entire Hawkins definition is as follows: "To *pass off in vapor*, to *escape* and *be dissipated* either in visible vapor or in particles too minute to mention." This dictionary would accord

to the noun "vaporization" only the meaning which we ascribe to the word in the Dubbs patent and would exclude entirely from acceptable usage the meaning for which respondent contends.

(g) As indicated in the dictionary definitions above discussed, vaporization has been held to be synonymous with evaporation. Professor J. W. Hinchley, in an article entitled "The General Problem of Evaporation" (vol. 41, Society of Chemical Industry (Transactions 1922), p. 242t) states:

> "The common meaning of the term 'evaporation' is vaporization of a liquid at some temperature below its boiling point, but in the technical sense, the word may be considered to be synonymous with vaporization."

Likewise, Professor W. H. McAdams, of Massachusetts Institute of Technology, in an article entitled "Basic Principles of Evaporation, Distillation and Drying", 3 Journal of Chemical Education, February 1926, page 157, defines evaporation as one of the vaporization processes, stating:

> "There are certain basic principles applicable to all vaporization processes. These principles apply not only to the three most important operations, evaporation, distillation and drying, but to other vaporization processes, such as humidification and dehumidification, and water cooling."

Ludwig Schmidt, in his article entitled "Applied Methods and Equipment for Reducing Evaporation Losses of Petroleum Gasoline" (U. S. Dept. of the Interior, Bureau of Mines, Bulletin No. 379, 1933), uses the terms "vaporization" and "evaporation" equiva-

lently and interchangeably, and then adopts the following definition (p. 4):

> "In its broadest sense, evaporation may be defined as the change by which any substance is converted from a liquid or solid phase and *carried off in the vapor phase.*"

These statements, together with the quotation from scientific works appearing in Doctor Brown's testimony and above quoted, make it plain that the noun "vaporization", as a matter of common dictionary and scientific definition may be used to connote the meaning "liberation of vapors." The Dubbs use of the word with that meaning is therefore nothing peculiar to the Dubbs patent and should be found acceptable by the Court in giving to the patent the only construction which will make the claims consistent with the specification. Such a meaning for the word "vaporization" can be consistently applied wherever that word is used throughout the patent.